SCIENTIFIC AMERICAN

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Illustrating Department.

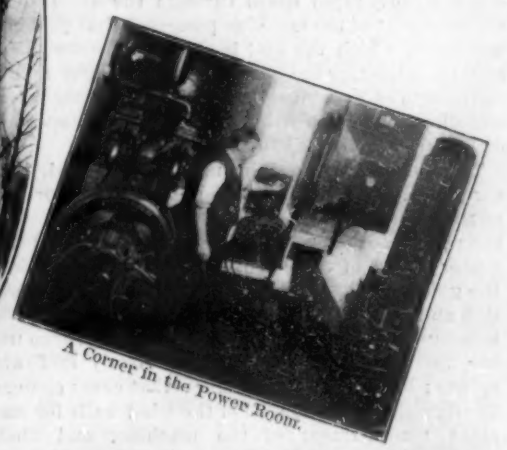
Mailing Department.

An I. C. S. Student Studying.

Front View of Main Building.

An I. C. S. Student Experimenting.

An I. C. S. Student "Reciting"



A Corner in the Power Room.

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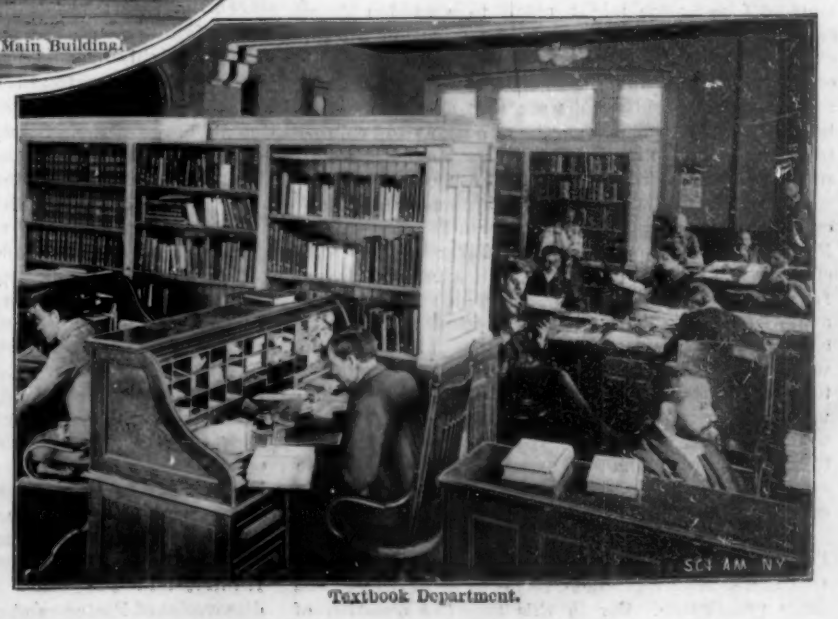

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AIRSHIP OR AEROPLANE—WHICH?

The quest for a successful means of aerial navigation has been prosecuted along two different lines, according as the inventor aimed at the construction of a navigable balloon or airship, or a flying machine or aeroplane. The early flying machines, in which suspension and forward motion were attempted by imitating the flapping wings of a bird, were futile and wofully fatal. In later years they have given place to the scientifically conceived soaring machine and motor-driven aeroplane. On the other hand, the old pear-shaped balloon, which depends entirely upon the wind for propulsion, has developed into the modern, cylindrical, screw-propelled airship. The progress of invention in aeronautics has been marked, sometimes by a preference for the aeroplane, sometimes for the airship type. To-day, it must be confessed, the latter is most in the public eye, chiefly because of the stupendous proportions of the Zeppelin airship, now nearing completion on its floating dock in Lake Constance.

The popularity of the aeroplane, and the widespread conviction which was noticeable a few years ago, that this type would be the machine of the future, were based upon the fact that it was built upon the principles which govern the flight of birds. Since we now understand the laws of flight, and improved materials of construction have enabled us to build flying machines that are gradually, if very slowly, approaching the bird in their ratio of power to weight, it was argued that the production of a successful flying machine was a matter of time merely. It is probable, however, that in coming to this conclusion, sufficient importance has not been attached to the human element, upon which the successful operation of the aeroplane is absolutely dependent. It would no doubt be possible to build an aeroplane that would carry a person at a fairly rapid speed through the air, provided the occupant of the machine possessed that God-given faculty by which the bird is able to preserve its equilibrium, adjusting the position of its weight and the inclination of its wings to the ever-changing velocity and direction of the wind, and the varying speed and direction of its own flight.

This matter of equilibrium is determined, in the aeroplane, by the inter-relation of several factors, such as the speed, the inclination of the supporting planes, the position of the center of gravity with regard to the center of area of these planes, and the inclination of the guiding tail. It requires rare quickness of perception and judgment to keep all these factors in the harmonious equipoise necessary to equilibrium, even under the favorable conditions of a perfectly still atmosphere; but when we remember that every change in the direction and strength of the wind calls for an instant readjustment of the machine, and that a moment's hesitation might result in a sudden dive earthward, the perils of aeroplane navigation will be evident. The fatal mishaps to Lilienthal, Pilcher and others were due to a failure to control the equilibrium, and the present indications are that as long as the balancing is dependent upon the sensations and voluntary control of the operator, aeroplane navigation will remain a very hazardous and fatal form of recreation.

It is evident that some method of automatic mechanical control is necessary, and the results achieved by Professor Langley on the Potomac River indicate that such control is within the possibilities of the future. In perfectly still air the Langley steam-driven aerodrome achieved a steady flight of three-quarters of a mile at a speed of thirty miles an hour. But although this was a truly wonderful result and speaks eloquently for the skill and unconquerable perseverance of the inventor, the aerodrome is to-day nothing more than a wonderfully ingenious toy. It is a far step from that to a machine of commercial or military utility, capable of carrying its freight in any direction in all possible conditions of wind and weather.

The airship (using that term to include all gas inflated machines), though not by any means so attractive as a scientific problem, seems to be at present the more practicable. For in this type the question of suspension in mid-air has no necessary relation to the speed, as in the case of the aeroplane, and the efforts of the operator may be devoted entirely to steering and propulsion. Given a sufficient volume of gas and a containing cylinder of the proper strength, there is theoretically no limit to the weight which may be lifted. It is in providing a motor sufficiently powerful to propel the huge structure against a strong opposing wind that the difficulty lies. This has never been accomplished as yet, and there is no expectation that even the mammoth Zeppelin airship will be able to make headway against anything stronger than a moderate breeze. Its proposed speed is 22 miles an hour, and hence it will be helpless against a wind of that velocity. Nevertheless, if this distinguished German succeeds in achieving this speed with an airship capable of carrying a crew of several men, he will have placed the problem of aerial navigation on a practical basis which it has never hitherto reached.

The Zeppelin airship, which is illustrated and described in the SUPPLEMENT of November 11, 1899, is of unprecedented size. It consists of a conical-ended cylinder 39 feet in diameter and 410 feet long, carrying two parallel, boatlike cars below it, in which are placed two 15 horse power benzine motors for driving the propellers. The hull consists of an aluminium framework surrounded with a strong netting, within which will be 17 separate, independent, airtight gas balloons, the arrangement resembling that of the watertight compartments of a steamship. The ship will be trimmed by means of a weight sliding on a cable suspended below the cars. By sliding the weight aft, the bow will be thrown up and the reaction of the air will cause the ship to rise; the contrary movement of the weight will depress the bow and cause the ship to sink. Unless some unforeseen difficulty arises, we may expect to learn the results of the trials of this Brobdingnagian at any moment, and their publication will go far to determine the possibilities of aerial navigation on a practical and commercially useful scale.

THE DALMENY EXPERIMENTS.

The great problem for the British farmer, and in fact the farmer in any old country, is how to produce the best possible crop at the least possible cost, so as to compete with the enormous quantities of grain and other agricultural products which are sent in from the United States, Argentina, and other cereal-producing countries. Artificial fertilizing is absolutely essential to successful farming in Great Britain, and the great importance of the subject was recognized early in the history of modern scientific agriculture. In 1843, the renowned Rothamsted experiments were started by Sir John Bennet Lawes, who has provided a heavy endowment fund, so that experiments can be carried on in perpetuity. For fifty-six years the same kind of grain crops have been grown on the same plots and the same kinds of fertilizers year after year, each section having one or more plots upon which crops have been grown continuously without any kind of manure. The value of these experiments has been very great, and was an inspiration to make many public bodies, societies, etc., establish similar experimental stations.

In recent years bacteriological science has proved beyond the possibility of cavil that in the great cycle of change, from the organic matter in the soil to the elaborate products which are absorbed by the roots of the plant, the bacteria of the soil are the great, and indeed the only agents employed. It is now a proved scientific fact that the decomposition of organic matter in the soil is due to bacterial action and to the action of various crops of soil organisms. It is also a proved fact that the wart-like excrescences on the roots of leguminous plants are the camping grounds of myriads of bacteria which possess the property of being able to absorb the free nitrogen of the atmosphere and render it favorable for the use of plants. This science has also shown that caustic lime will destroy the nitrifying and other advantageous soil organisms, whereas carbonate of lime is highly beneficial to them, and, in fact, where the organisms are found in the greatest numbers and greatest activity, it is absolutely essential to the due discharge of their function. Therefore, the bringing about in the soil of those conditions which favor the development and action of those nitrifying and other advantageous organisms is the great aim and end of scientific fertilizing; for the farmyard and artificial manures applied to the soil are not taken up direct by plants, but go in the first place to feed the crops of soil bacteria, which in turn provide the highly elaborated material to be absorbed by the roots of the plants. For several years it has been held as a proved scientific fact that the oxidation of organic matter in the soil, which was formerly held to be a purely chemical change, was due to the action of soil bacteria. The Nineteenth Century has just published a most interesting article by Mr. D. Young on the "Dalmeny Experiments," from which we obtain our information.

Some eighteen years ago, the two founders of what is called "New Soil Science" were interested in the study of soil bacteriology; one of them was John Hunter, and the other Professor M'Alpine. The discoveries of Pasteur and other investigators as to the paramount importance of having the right crops of yeast plants in the production of beer was doubtless the means by which Mr. Hunter was led to recognize the equally great importance of having in the soil the right crops of soil bacteria. The nodules on the roots of the Leguminosæ were first investigated, and as a result Messrs. Hunter and M'Alpine demonstrated the fact that the bacteria in these root nodules did possess the power of absorbing the free nitrogen of the atmosphere and render it available for the use of the plant. They then proceeded to carry out a series of investigations in regard to the nitrifying bacteria. At an eagly stage in their work they found there were several well-defined sets of bacteria concerned in the work whose final end is nitrification. They succeeded in isolating and cultivating the nitrous germ and they also isolated what they believed to be the nitric germ, but in the case of the latter they were for a time puzzled to find that they could not, from it in any ordinary culture media, produce nitrates. Finally they remembered the plan by which Napoleon was able to secure from the old mortar in the Paris stables a supply of nitrate for the manufacture of gunpowder. They accordingly added a small supply of mild lime in the form of mortar to the culture media, with the result that the nitric germs produce nitrates quickly. The experimenters thought that the old dressings of hot lime were a mistake, but that a small annual or biennial dressing of lime compost to the surface soil was essential in successful and scientific fertilizing.

Naturally their views were bitterly opposed, but at last the time came when the doctrines of the New Soil Science could be tested under the most favorable conditions. The post of land agent on Lord Roseberry's estates becoming vacant, a pupil of Mr. Hunter's, named Drysdale, was appointed. The latter commenced experimenting on a small scale with various fields, and with such satisfactory results that Lord Roseberry decided to extend the work. In 1895 a well equipped experimental station was established on his lordship's farm at Dalmeny Park, with Mr. Hunter as scientific adviser. The results of the experiments were carefully tabulated and would fill a good-sized volume. With a moderate dressing of farmyard manure supplemented with 4 cwt. of ground lime, applied at the working of the land, followed by 4 cwt. superphosphate, 1 cwt. of fermented bones, 2 cwt. of kainit and 1 cwt. of ammonium sulphate, the Dalmeny home farm produces crops which are the admiration of all.

The "Dalmeny Experiments" are of far-reaching importance. There are now, at least, six lime works which are kept constantly at work grinding lime owing to the ever-increasing demand for that substance, and the scientific authorities who had at first considered the new soil science as a heresy have been obliged to admit that nothing succeeds like success.

THE SECRETS OF OUR SUCCESS IN THE STEEL TRADE.

When the statistics of the steel trade of the United States for the year 1899 are completed, there is every probability, judging from the records for the past ten months, that this country will have produced a grand total of between twelve and thirteen million tons. This is equal to the total production of the whole world in 1871, and is fully one-half of the world's production ten years ago. We have not only outstripped every competitor, including Great Britain itself, but so rapid is the growth of the American industry, that the time is within measurable distance when even that country will be but a poor second in a comparative list of production.

It is now nearly half a century since the Hon. Abram S. Hewitt, who has always shown a firm grasp of the economics of the industry with which his name is so closely associated, stated that the essential conditions to building up an iron trade commensurate with the importance of the United States and the enormous demands of the future, were three. First, there must be an adequate supply of the raw materials, ore, coal and limestone; second, they must be so far contiguous, geographically, that they can be brought together at the furnace at small cost of transportation, and the product be cheaply placed at the various markets; and lastly, there must be no stint of capital to build, equip and carry on the works. Now, in view of the fact that these words of Mr. Hewitt, spoken in 1855, do actually describe the present favorable conditions in the United States, they may be taken as being truly prophetic.

As a matter of fact, everyone of these conditions is not only present, but it is fulfilled with a completeness far beyond the most sanguine forecast. In the first place, the United States possesses in the Lake Superior and adjacent iron mines the most extensive and most easily worked deposits in the world. Nature could not have placed the raw material in a more ideal and convenient form for cheap and expeditious recovery from its geological resting place; and science and art have nobly responded in providing the necessary excavating tools for the cheap mining and transportation of the ore to the smelting furnace. The iron mines of Lake Superior are matched by the vast coal fields of Pennsylvania, and the genius of the American engineer has devised a system of transportation by ship

and rail which enables the two raw materials to be brought together at the furnace at a low cost of transportation which cannot be matched in any part of the world. The lake steamer, with its engines placed at the stern and the whole of the hull available for carrying the ore in bulk, the vast systems of ore pockets equipped with labor-saving machinery in the way of hoisting cranes, cableways, etc., and lastly the American system of cars and locomotives, enabling vast loads to be hauled by single units of exceptional power, all combine to give to the industry a long lead in the race, even before the raw materials have been mixed ready for smelting.

But the economies do not stop with the mining and transportation, but are continued throughout the whole process of smelting, blowing, and rolling into finished shapes ready for the market. European ironmasters who have come over to study the cause of our cheap production, have frankly admitted that by our peculiar system of management and persistent endeavor to substitute mechanical for manual labor, we have succeeded in producing a larger output from a given plant than is possible under their own methods.

As to the last essential to success mentioned by Mr. Hewitt in 1855, the necessity for abundance of capital to build, equip, and carry on the works, it is enough merely to call to mind such vast industrial concerns as the Carnegie consolidated interests, representing an aggregate capitalization of $500,000,000, to realize that our position in this respect is as strong as in every other. The commanding position of the iron and steel industry in this country in respect of its geological and geographical advantages alone would be sufficient to secure a response to any possible demand for capital.

There is every reason to expect that our growth in the future will at least keep pace with that of the past. Of course, our competitors will gradually approach us in the matter of management and improved methods of handling; but in the wealth of our natural resources and the facilities due to geographical position, we shall always hold a commanding and unassailable position.

THE DANGER FROM THE IMPORTATION OF ANIMALS.

An abstract of J. S. Palmer's essay on "The Danger of Introducing Noxious Animals and Birds" appears in Our Animal Friends. There are several societies in this country for the express purpose of purchasing and importing European birds. One society in Cincinnati has contributed $9,000 to this object, and other cities have raised considerable sums. Our contemporary thinks it would be well that all such experiments should be made under the sanction of government experts of the Department or Agriculture. In addition to voluntary importations, it often happens that animals are unintentionally brought into the country, as trading vessels have carried the European house mouse all over the globe, and the introduction of rabbits into Australia is perhaps the most striking example of the dangers of unconsidered importations. They were introduced for purposes of sport, and were liberated near Melbourne in 1864. Within twelve years they had spread over the country and became a veritable plague, and millions of dollars have been spent for bounties, poisons and other methods of destruction. Thousands of miles of rabbit-proof fences have been built, and in 1887 no less than 19,182,589 rabbits were destroyed in New South Wales alone, and the rabbits seem to be on the increase. The little Indian mongoose was imported into Jamaica to cope with a plague of rats and proved most effective, but after it had destroyed the rats it turned its attention to the domestic animals and poultry, so that the islanders would now be glad if they could get rid of the pests. Such are a few examples of the danger of disturbing nature's balance.

WIRELESS TELEGRAPHY TESTS IN SWITZERLAND.

A series of interesting experiments in wireless telegraphy has been carried out between Chamonix and Mont Blanc in order to find out the effect of the high altitude and different atmospheric conditions of those regions. This work was undertaken by two French engineers, Messrs. Jean and Louis Lecarme, who afterward made a report to the Academie des Sciences. The experimenters wished to find out also the effect of the atmospheric electricity, and whether the absence of moisture in the frozen soil would render the earth connection impossible. The tests were carried out for several days in succession, commencing with the 25th of August; it was found that the signals were easily transmitted and read with a distance of two centimeters between the spheres of the oscillator. It was found that the absence of moisture in the soil did not interfere with the earth connection, and also that clouds interposed between the two stations had no appreciable effect upon the signals. The action of atmospheric electricity made itself felt at times, but on the whole the effect was not sufficient to prevent the practical working of the apparatus. It was also observed that the operation of the alternating current dynamos of the Chamonix lighting station had a marked effect upon the apparatus, and it was impossible to work while the dynamos were running. These machines are of the three-phase type and give 2,500 volts.

IMPORTANCE OF PATENTS AND TRADE MARKS IN GERMANY.

The afternoon session of the fifteenth day of the International Commercial Congress, at Philadelphia, was devoted chiefly to the question of international trade marks. Papers of great value were read by Commissioner Duell and by Mr. Francis Forbes, one of the committee of three appointed by the President to revise the trade mark laws so far as they relate to foreign commerce. Commissioner Duell's paper was printed in the SCIENTIFIC AMERICAN of November 11. In the discussion of Mr. Forbes' paper on "Present Trade Mark Needs in International Trade," the Hon. J. C. Monaghan, United States Consul at Chemnitz, Germany, referred to the value of patents in Germany as follows:

I do not know that just what I am going to say is exactly germane to any particular paper; but after long experience abroad, I have come to the conclusion that it would be wrong for me to omit so excellent an opportunity to call the attention of American inventors and manufacturers to the importance, the very great importance, of securing letters patent in Europe, and particularly in the German Empire.

I have sometimes been accused of calling the Germans a race or nation of imitators. While they are one of the greatest nations of imitators in the world, I would not be understood as saying that they are not great originators. Any person familiar with the fact knows that they have practically given gunpowder to the world through their monk Schwartz, and the printing press, the greatest probably of all inventions, through Gutenberg, Schoeffer and Faust, and that they are to-day in chemistry and in various branches of the sciences and arts, leaders among all nations.

I repeat, when one is familiar with these facts, it becomes impossible to deny to the Germans the credit of being great inventors and great originators. What has stood particularly in the way of their progress as a race of inventors in the past is this fact, that prior to the year 1878, when Germany had passed her Imperial Patent Law, it was absolutely necessary to take out Letters Patent in Saxony, Wurtemberg, Bavaria, Mecklenburg, etc., etc., and some twenty-eight or thirty petty states and sovereignties. The Imperial law has got away with that fact, and since 1878, she being number fourteen among the inventive nations on the earth, has become, if I remember, mentioned among the first, second and third nations, being led by our own people. But the point I wish to make is this: That American manufacturers and inventors, being magnificent inventors, neglected patent rights in the German Empire, and the law is that the clever genius of that people, watching, as perhaps no other people on the face of the earth, the scientific progress of the world, took out patents. In my city I suppose there are dozens of men, manufacturers, who take the patent papers and the various technical papers of this country, and keep themselves posted as to everything that occurs here. The technical school of my city, the leading technical school, has on file the leading patent papers of our country and the records which they give here, and they see our machines of all kinds. They buy more or less and take them home, where they take them apart and use them as models.

I had in my mind the case of a manufacturer in this city, one builder, who invented the finest gear cutter probably there is in the world. He sold the machine to the leading toolmaker in my city and sent a young man for the patent and set up the machine. They bought another, and then another, and had some correspondence. I am told—in fact, I know—they could not take one machine apart, and they are now constructing a machine for themselves and selling them.

Now, Mr. Chairman, I do not want to be understood as finding fault with that concern for doing that thing. The point I want to make is that Mr. Fletcher, or any inventor in this country, who has taken care to ask an American patent lawyer to have the patent taken out in the German Empire, will be protected, and I think these gentlemen here who are more familiar with the patent laws than I am, know there is no patent country, except perhaps ours, where an inventor has better protection than in the German Empire when he does get a patent.

THE AUTOMOBILE IN BUENOS AYRES.

The use of the automobile in Buenos Ayres is rapidly increasing, and vehicles of the electric and petroleum types are now frequently met with in the streets of that city. These include not only private carriages and tricycles, but also heavy delivery wagons for the use of large stores. The fact that facilities for making repairs are lacking has been hitherto a drawback in the use of these vehicles, but as a result of their adoption there is no doubt that these facilities will soon be provided, and besides, the condition of the roads is beginning to improve. A further step in advance has been the formation of the Argentine Touring Club, which has been founded not long since by a number of influential amateurs and commercial men. The new society will devote itself to the question of automobile interests, and one of the first steps taken has been that of the establishment, in all the provinces of the Argentine Republic, of roads which are specially reserved for bicycles and light automobiles. These roads have already commenced to radiate from Buenos Ayres to a distance of 60 to 70 miles, and it is intended to continue the work until a good system of roads is established throughout the country.

END OF THE CREUSOT STRIKE.

The Creusot Works, which has now recommenced operations after the recent strike, is one of the great European centers of production, and not only transforms the ore received into iron and steel, but also produces in its extensive factories a great variety of manufactured products, such as cannon, shells, boilers, locomotives, armor plate, and also builds different types of dynamos and other electrical apparatus. As is of course necessary in a large establishment of this kind, everything is carried out upon an improved plan with an extensive and modern equipment; the great pieces are handled and transported with ease by the cranes arranged for the purpose, and a well studied system reigns throughout the entire establishment.

The factory covers an extensive area, and is situated in a plain or basin surrounded on all sides by hills, and under these the railroad penetrates by a tunnel to reach the extensive system of tracks which have been laid for the handling of the ore and finished products. The establishment was founded as far back as 1808, and started at that period as a glass works; from that date to 1818 it was under the direction of the Société Perrier. The venture was not a paying one, however, and the losses of the company during the ten years of operation reached as high as 14,000,000 francs. It then passed into the hands of M. Chagot, who came out of the affair with a loss of one million; an English company, Manley & Wilson, then spent without success eleven millions upon the plant, and it was not until 1836 that under the direction of the Schneider Company the Creusot Works began to assume a prosperous condition. From that time to the present there has been a continual progress up to the flourishing condition which is now to be seen. There are over 9300 workmen employed in the different shops, and these are distributed as follows: Forges, 2827; machine shops, 2131; steel works, 1450; artillery, 568; blast furnaces, 513; mines, 388; electrical machines, 341; besides different auxiliary services, which are estimated at 1085.

The working day is of ten hours, and day and night turns are taken each alternate week. The wages paid vary from 2·50 francs to 3·75 for the laborers, which includes a quarter of the personnel; from 4·50 to 8 francs for skilled labor; and for special kinds of work as high as 10 to 15 francs are paid. These figures must naturally be compared with the cost of living, which is much lower in France than in the United States. The workmen have established six mutual aid societies and twenty or more co-operative establishments and stores; the bakery, for instance, supplies 3,500 families. Up to the time of the last strike the works were in full prosperity, with an abundance of orders from all quarters, and there is no doubt that within a short time the normal state of affairs will be restored. The production of electrical apparatus is now an important branch of the establishment, this being materially facilitated by the abundant supply of metal, and the attention which has been given to the production of magnetically good iron and steel for the machines. The production of armaments and ammunition of all kinds is one of the principal features of the establishment, and orders are received from the home government and the different nations of Europe.

The company owns extensive mines, but these do not suffice for the supply of coal and minerals necessary to carry on the work, and in consequence, extensive importations are made; a large part of the coal, for instance, is brought from England. In order to facilitate the handling of materials, the company is now erecting a branch establishment at Cette, an important sea port of the Mediterranean, and from these works the heavy products may be put directly on board, thus eliminating railroad expenses. At the same time, coal will be landed from the Algerian mines as well as from those of other Mediterranean countries. The yearly consumption of materials may be observed from the following figures for 1898: Coal, 510,000 tons; coke, 150,000; ores, 200,000; pig or cast iron imported, 40,000 tons. As to production, the figures for the same year show cast iron of all kinds, 105,620 tons; steel, 125,680; wrought iron, 46,740. When the works at Cette are finally installed, the Creusot establishment will keep only the steel works, artillery, and electrical machinery.

Automobile News.

Steam plows are to be used in South Africa for intrenching works.

An English physician has driven a motor carriage 5,000 miles at an expense of only $130.

There is a regular service of automobiles between Newcastle and Sunderland, and other systems are projected in various parts of England.

In England the automobile has begun to figure so frequently at weddings, according to The Motor Car Journal, that soon little or no notice will be attracted by the use of the same.

President McKinley has at last ridden in an automobile, actuated by steam. Washington is an ideal place for motor carriages and should be a good field for companies dealing in them.

An unfortunate accident occurred a few days ago on a gasoline-propelled automobile. The tube connecting the gasoline tank with the motor broke, and as might be expected, the escaping fluid took fire and enveloped the vehicle in a sheet of flame. The occupant was badly burned.

It is stated that automobile omnibuses will be substituted at once for the old horse-drawn stages on Fifth Avenue, New York city. We understand that the omnibuses will not be allowed to be crowded, and a little sign bearing the word "Full" will be displayed when every seat is taken. This is the general European custom.

The New York Medical Journal, speaking of the recent explosion of the gasoline tank of a motor carriage, says: "Some new danger is almost always to be expected in connection with novel devices of the kind, but, on the whole, the power carriage, whether propelled by gasoline or electricity, is probably less dangerous than vehicles drawn by horses."

A gold cup for international competition has been offered by the Automobile Club of France. The first test will be held as near May 1 as possible, the idea being to make the date coincide with the great automobile day at the exposition. The rules which will govern this cup have not been made as yet, and it is expected to arrange racing conditions which will be satisfactory to automobilists of all countries.

A test of a truck made by the Auto-Truck Company was witnessed by the prominent officers and stockholders on November 26. It was of the Hoadley-Knight type and was built at the International Power Works at Providence. The truck was brought down by boat, and was run to the air-compressing station of the Metropolitan Street Railway on Twenty-fourth Street with the charge which it had received in Providence. A fresh supply was taken on, and it was demonstrated that it could be satisfactorily run in the streets.

AN X-RAY DELUSION.

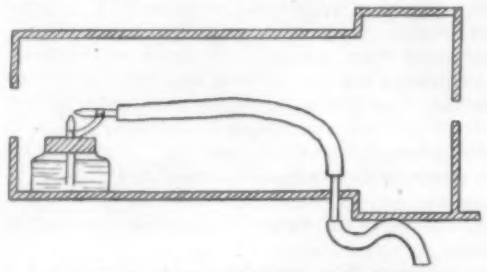
BY GUSTAVE MICHAUD, D.SC.

A Boston firm sells, under the name "X-Ray camera," an apparatus which apparently enables an object to be seen through any opaque substance. It is hardly necessary to say that the X-rays have nothing whatever to do with the phenomenon, which is really produced by a set of four hidden mirrors, that conduct the light around the opaque object. I have recently devised and constructed a little apparatus, which is just as deceitful as the "X-Ray camera," but which is more readily made and gives results by far more astonishing for spectators who have not been told the secret of its construction. It apparently reproduces instantaneously and neatly the interior of the human body, giving to every organ its natural color. The whole operation is performed under the eyes of the bewildered sitter, who watches the X-rays in what seems to be the act of drawing and painting before his eyes his vital organs.

The apparatus looks like the objective tube of a camera, with the plate on which the image is to be produced in full sight of everyone. The apparatus is placed opposite the person whose viscera are to be photographed, and to heighten the effect a lamp may be solemnly placed behind the sitter. The operator invites everyone to look at the white sheet of paper, and presses the rubber bulb of the shutter. A colored image appears instantaneously on the paper. The lungs are of a bright red color, the heart is darker, the veins are blue, the stomach and intestines are of a greenish tint; other parts of the body paint themselves in black on the white paper. This sudden apparition generally startles the sitter; but a few remarks on the healthy looks of his lungs will place him at his ease. The photograph is taken out of the apparatus and passed among the spectators.

Two distinct parts of the apparatus co-operate in the production of that X-ray trick; namely, the sheet of paper and the objective tube.

Before the experiment, the sheet of paper is treated as follows: It is pinned over any anatomical drawing showing the position of the principal thoracic and abdominal organs. If the sheet of paper is not too thick, the drawing can be seen through it. The space occupied by the lungs is then painted with a diluted solution of sulfocyanide of potassium. A more concentrated solution of the same salt is used to fill the space outlined by the heart and principal arteries. A few big veins are painted with a solution of ferrocyanide of potassium. A more diluted solution of the same salt is used for the stomach and a few intestinal folds. The rest of the body is uniformly painted with a concentrated solution of tannin. The whole operation need not take more than five minutes. When the paper is dry, the drawing is absolutely invisible, for all the



INTERIOR OF THE OBJECTIVE TUBE.

APPARATUS FOR PRODUCING AN X-RAY DELUSION.

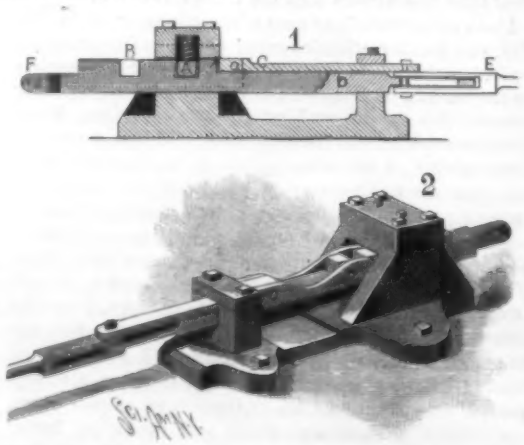
above named solutions are colorless. The sheet of paper is now ready for use in the apparatus.

The objective tube does not contain any lens, but merely a small atomizer filled with a solution of ferric chloride. When pressed the rubber bulb sends air, not as every spectator believes, into a pneumatic shutter, but into the atomizer. As a result a fine and invisible spray of the perchloride of iron solution reaches for a moment the sheet of paper. What follows is easily understood by every student of analytical chemistry.

The reactions between ferric salts on one side, sulfocyanide of potassium, ferrocyanide of potassium, and tannin on the other side, are among the most sensitive of analytical tests, owing to the extraordinary intensity of the red, blue and black colors which originate in these reactions. Hence the instantaneous production of the colored picture.

A SAFETY SWITCH-LOCKING MECHANISM FOR RAILWAYS.

An invention has been patented by William Haney, of Lexington, Ky., which provides an ingenious means for opening and closing railway-switches and for locking the switch-tongue in its adjusted position, to prevent possible accidents.



HANEY'S SWITCH-LOCKING MECHANISM FOR RAILWAYS.

The switch-operating mechanism comprises a shifting-bar, *F*, formed with two transverse notches, in which a spring-pressed locking-bar, *A*, is designed to engage. At opposite sides of the shifting-bar, cam-plates, *B*, are arranged, which are curved so that their highest points are on a plane with the top of the shifting-bar. The cam-plates, *B*, are connected by means of a link, *C*, with an operating rod, *E*, leading to a switch-tower and can be moved independently and with the shifting-bar. The link, *C*, is connected with the rod, *E*, by means of a bolt passing through a longitudinal slot in the shifting-bar.

When the locking-bar, *A*, is in the first notch, as shown in Fig. 1, and it is desired to shift the switch-tongue in an opposite direction, the rod, *E*, is pulled outward, thus drawing the cam-plates, *B*, longitudinally and causing the curved portions to raise the locking-bar, *A*, against its spring. During this motion the bar will remain stationary, because the bolt connecting the rod, *E*, and the link, *C*, is traveling in the longitudinal slot of the shifting-bar; but when the bolt reaches the end of the slot, the cam-plates and shifting bar will be drawn together, until the locking-bar moves into the second notch, thus locking the switch-tongue in adjusted position. The movements are reversed when the parts are shifted to their first position. Since the boxing in which the locking mechanism is contained is covered, the parts cannot become clogged by snow, ice or dirt.

Some Reminiscences of Early Marine Steam Engine Construction and Navigation in America.

At a late session of the Institution of Naval Architects of Great Britain, Mr. Charles H. Haswell, the well-known engineer, who may be regarded as the Nestor of his profession, having recently completed his ninetieth year, presented a second paper on early marine steam engine construction and steam navigation in the United States navy from 1807 to 1850. Mr. Haswell's papers are of great interest in view of the following claims which are set forth in them. According to them, Mr. John Stevens, of Hoboken, N. J., in 1809 applied slides and a crosshead to guide the piston rod of a steam engine. In 1824 James P. Allaire introduced the Woolf engine, the compound of the present day. The first introduction of steamboat towing was made in 1825 by a New York company. In 1826 a fan blower was introduced by Robert L. Stevens. In 1827 J. P. Allaire invented and patented the steam chimney. In 1836 sponsons were first constructed under the water-wheel guards of a steamer. In 1837 the first steam launch was designed and directed by Charles H. Haswell, Chief Engineer, United States navy. In 1839 Francis B. Stevens invented and patented the double eccentric cut-off. In 1842 F. E. Sickles invented the drop valve cut-off; the same year Edwin A. Stevens designed and operated a closed fire-room. In 1844 Charles H. Haswell, Chief Engineer, United States navy, devised the application of zinc to the bottom of an iron vessel and in a marine boiler. In 1846 Capt. John Ericsson designed and applied a surface condenser to the engine of a United States revenue cutter. In 1848 Mr. Pierson improved upon it, and soon after Chief Engineer William Sewell, United States navy, further improved the construction, and in the same year Frederick E. Sickles devised the application of steam to the steering gear of a steamer. The Right Honorable the Earl of Hopeton in the course of some pleasant remarks said: "Gentlemen, may I remind you that Mr. Haswell, the author of this paper, is, I fancy, about the oldest practising engineer in the world. He was Chief Engineer of the United States navy at the time Her Majesty came to the throne, and that was not yesterday. I may also remind you that he was present at the International Congress held about a year ago, and was among the youngest of us. He was here, there and everywhere. . . . I propose that the secretary be authorized to send our best thanks to our veteran friend for his kindness in sending this paper."

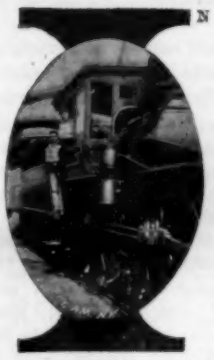
Insurance Against Earthquakes.

Dr. Barrata has advocated in the Italian parliament a compulsory insurance against earthquakes. Owners of vineyards and others protect themselves in this way against hail and, therefore, why not against another calamity even more destructive, as they average about 750 shocks a year and certain parts of Italy have occasionally suffered terribly. The idea of the insurance is a shrewd one from the point of view of public economy. It shifts the burden from the exchequer to private purses. The business would be of a peculiarly risky nature, for such an epidemic of earthquakes as has devastated Calabria between 1783 and 1786 might easily bring any ordinary company to bankruptcy. The risk would have to be widely spread, and actuaries would be puzzled to calculate the premiums for different places. Some parts of the peninsula enjoy practical immunity. The great plain of Venetia has never suffered. Rome and Naples are occasionally shaken, although as a rule not seriously, but disaster frequently occurs in volcanic districts, as in Ischia in 1881 and 1883, when the loss both of life and property was serious. Calabria is far the worst as an earthquake region. Over 1,400 people perished in one locality in the period mentioned above.

THE highest observatory in Germany is situated on the Schnee Koppe, the highest summit of the Silesian Mountains, the elevation being 5,216 feet. It will be managed by the Prussian authorities.

RAILWAY SIGNALS.

BY C. FRANCIS JENKINS.



IN no other corporate industry have organization and efficiency been more highly developed than in the railroads of the United States. The most perfect illustration of this is the enormous amount of passenger traffic which is safely handled every year over the thousands of miles of rail-girded country. This has become possible only by the development of a system whereby accountability is clearly and accurately defined. Presiding over the great army employed are men of the highest order of ability—men competent to deal intelligently with the varied conditions incident to the smooth and safe movement of the trains. The recent establishment of a schedule of mile-a-minute trains between the Atlantic seaboard and the Rocky Mountains certainly indicates the utmost confidence by both railway officials and the traveling public in the devices employed to safeguard traffic.

These consist, so far as the public sees, of what is known as the "block system." That is, the entire road is divided into short lengths or blocks marked by towers, each under the immediate charge of a signal operator. Three distinct types of signals are recognized, i. e., telegraphic, automatic, and manual-controlled, the primary purpose of each being the same, namely, the protection of trains from derailment and collision. The earliest and now obsolete form was the "time block," in the operation of which a certain interval of time had to elapse after a train had passed into a block before another was permitted to enter the same block. But as a time interval and not a space interval was the unit of safety between running trains, obviously it didn't protect.

In the telegraphic block system the operator is supposed to keep his signal set at "danger" until notified that the train has passed into the block ahead. But there is nothing to prevent a "clear" signal being shown through mistake or carelessness. This is more or less overcome in the "automatic" system, by which the passing of the train itself into the next block sets the signal at clear. It is necessary, however, to allow the following train to proceed after a time even against a danger signal; for it is impossible to know whether the signal indicates danger because a train remains in the block or because of the failure of the apparatus to work properly.

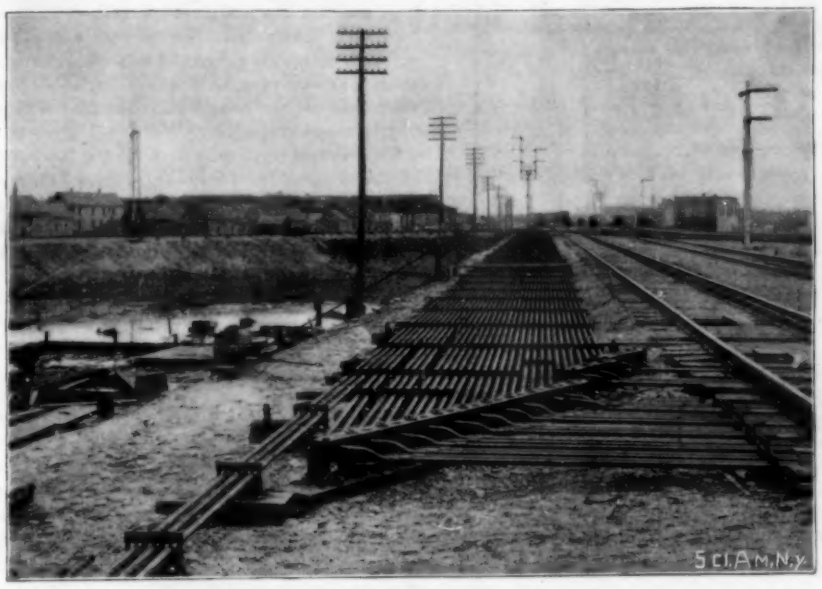
The latest and by far the best system in use is a combination of the manual and automatic. In this system the signals are set by hand, but are locked and released electrically by the operator in the next tower as well as by the passing of the train itself, the track being divided into electrically insulated sections for the purpose. Thus, it will be seen that it is almost impossible for a signal to be improperly displayed.

The signals or semaphores are paddles normally standing out at right angles to the supporting pole, indicating danger, and variously known in railroad parlance as "home," "advance" and "distant" signals. The home blade is square-ended, and, like the pointed advance blade, is painted red with a white band. The distant blade is "fish-tail" and painted yellow and black. The reverse of each is painted white with a black band. The opposite end of the blade has a little glass window which shows red at night. When the outer end is dropped it indicates clear track, and for the same purpose the light shows white at night. The light behind the distant blade is normally green, and means "caution." The signals are counter-balanced so that they always return to danger position, horizontal, if anything goes wrong with the controlling mechanism. All the signals are interlocking, so that it is impossible to clear one without clearing the other two. And not only are the signals interlocking with each other, but they also interlock with the switches of all crossovers and turnouts.

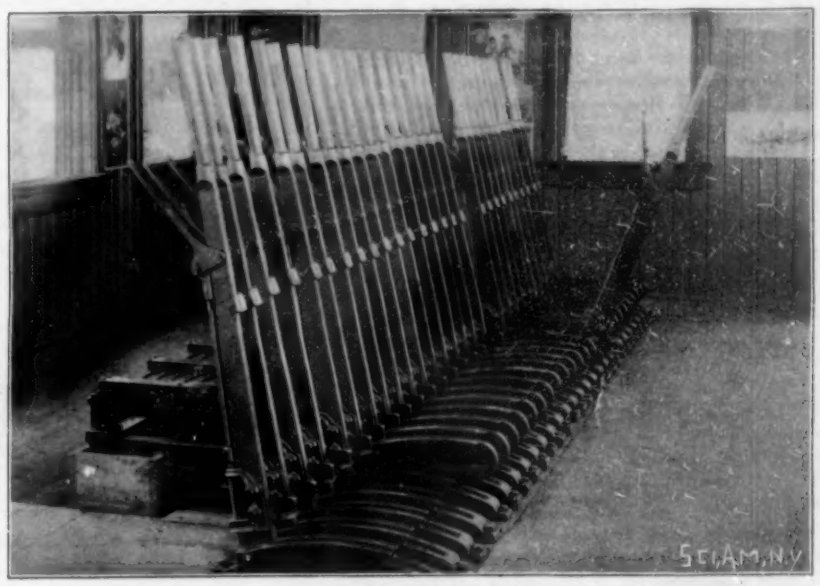
In the tower, where the operator, who is responsible for the safety of the trains, is stationed, are a number of levers attached to the signals by means of long pipes, a lever and a pipe for each semaphore. But none of the signals can be set until unlocked electrically from the next block by the passing train. It will thus be seen that a clear signal cannot be shown unless all switches are properly set and the train has entered the next block ahead. A collision is, therefore, impossible if the engineers obey the signals.

The installation of the system represents a large invested capital, but so efficient is the apparatus and so reliable the service, that it has been found to effect a great saving as against the amount yearly spent in fighting suits for damages incurred by reason of faulty apparatus. This, too, aside from the consideration of human life.

When the third-rail system of power distribution has become universal, as it most assuredly will, the running of each train will be under the direct supervision and immediate control of the train dispatcher himself. The towers, signals, and operators will continue as now, but the train dispatcher will know from personal observation the exact location of each train. Thus, in the train dispatcher's office will be a working model of the entire division over which he has jurisdiction. On each track is a miniature duplicate of each train speeding across the country. These miniatures start, run and stop in exact synchronism with the trains on the big tracks, so that the speed, location, progress, and condition of every train on the division is known to the dispatcher at a glance. On the table in front of him are a number of "keys." If a train passes a tower against a signal, he is able to



Semaphore, Switch, and Machine Connectors.



The Interlocking Machine Controlling Semaphores and Switches.

"Distant" Signal Set at Danger.

"Home" Signals. Top Blades for Passenger and Bottom Blades for Freight Tracks.

"Advance" Signal, Dropped to Indicate Right Track Clear.

bring it to a standstill by simply pressing the proper key, thus cutting off the current from the offending train and preventing collision. It is only another means by which the controlling mind is more effectively employed to still further reduce the number of accidents, which are now but one passenger killed to one hundred thousand safely carried.

For the illustrations accompanying this article, the writer is indebted to the Signal Engineer of the Chicago, Milwaukee and St. Paul Railway.

EDUCATION BY CORRESPONDENCE.

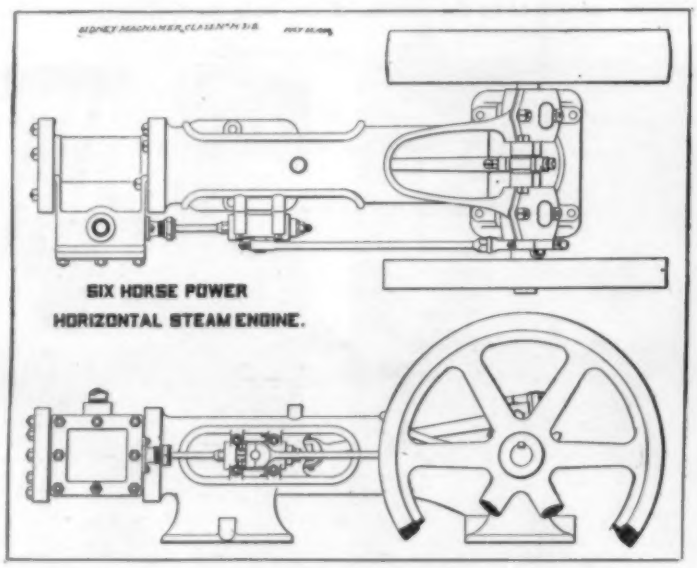
The rapid growth and remarkable popularity of schools of correspondence prove that this new system of education meets a distinct want and has come to stay. Their raison d'etre is to be found in the desire of the industrial classes to meet the demand of the technical trades for skilled workmen and foremen, whose education shall include something more than the three "R's" of the district school.

From among the many institutions that are giving instruction by correspondence, we have selected for illustration the International Correspondence Schools, of Scranton, Pa., for the reason that they are the original institution of the kind, and the largest and most representative of the many that are now in more or less successful operation. The Scranton establishment has 130,000 students on its books and is rapidly adding to this enrollment. Starting in 1891 merely as a school of instruction in mining, the scheme of education has widened to include practically the whole field of technical instruction, the intending students having the choice of some sixty separate courses, conducted by a corps of 226 professors and assistants. These figures are surprising and certainly go to prove that instruction by correspondence forms one of the most valuable educational agencies of the day.

Although the roll of the International Correspondence Schools includes the names of many people who are holding responsible positions in the various professions and are already possessed of a liberal education, the chief aim of the schools, as expressed by Mr. T. J. Foster, their founder and present manager, is "to enable people who are engaged in the industrial trades to supply deficiencies in their education due to lack of opportunity or application in their younger days." As thus defined, it is evident that the movement is operating in an entirely new field, being in competition neither with the high school, the technical school, nor the university. There is no question that the ambition of the average American to become a wage-earner frequently leads him to exchange the school for the workshop long before the former has had the necessary time to give him his proper equipment; and while he may for the first few years consider himself financially the gainer, it frequently happens that his advancement in his trade is brought to a full stop by the lack of technical knowledge. It is too late for him to "go to school again," for he can neither afford the expense nor is he willing to give up a position which he may not again be able to secure. The night-school, of course, in many cases affords a partial solution of the difficulty; but there are multitudes of workers for whom these admirable institutions are not available, especially in the thinly-populated and rural districts. Another type that is beginning to avail itself of correspondence instruction is the professional man who wishes to acquaint himself with the principles of a kindred profession, whose work at times overlaps his own. Such a case is that of the architect, who finds that a knowledge of the principles of engineering as applied to the design of framed metal structures is necessary if he is to be full master of his own profession. Many of the students, again, are educated men who wish to study special branches of engineering, or make a thorough review of their former studies; and hence, while the bulk of the students of these schools are drawn from the artisan and farming classes, there is a considerable and increasing number of students of broad education who are taking special courses in the more advanced branches.

The test of eligibility to become a student is that the candidate must be able to read and write English. The schools, to use the language of their prospectus, undertake to teach him "whatever he needs to know." In taking him through a course, the instructor proceeds upon the curious assumption that his pupil knows absolutely nothing about the subject. The assumption is curious and original, but thoroughly philosophical; for, if the student is acquainted with the earlier stages, he passes quickly through them, merely refreshing his memory, while the instructor is certain that in every case the student lays a proper foundation for future work. Starting, then, with the assumption that the student knows nothing of the subject, the schools send him his first and second Instruction and Question Papers.

After studying the first paper, he returns his written answers to the questions asked in the Question Paper to the schools, and proceeds with his second paper. At the schools the answers are corrected in red ink and returned to the student, accompanied by the third Instruction and Question Papers and a letter explaining the errors and corrections in further detail than is possible on the answer sheets themselves. If the student secures ninety per cent on his first paper, it is entered on the books as passed; but if he fails to get this percentage the paper is returned, and he is obliged to review the incorrect portion. This system is followed until the course is completed, when the schools' diploma is granted after a final examination. Although students are not limited as to the time required for the completion of a course, those that meet with difficulties are assigned to "special instructors," who are skilled in dealing with such cases.



SIX HORSE POWER HORIZONTAL STEAM ENGINE.

DRAWING TO SCALE, MADE BY A SIX MONTHS' STUDENT.

One of our illustrations shows a corps of women examiners at work, making preliminary corrections of such errors as occur in arithmetic, spelling, punctuation, etc. The papers are then submitted to the principals and male instructors for final inspection and the correction of such subjects as the women examiners are not qualified to correct, before being returned to the student. The transfer of papers is so arranged that the student has always something to study while the preceding papers are being corrected.

In describing a curriculum that includes no less than sixty separate courses, ranging from Arithmetic to Civil Engineering, it must suffice to take a single subject and let that stand for the whole. One of the most interesting and successful courses is that of Mechanical Drawing. In this, as in all subjects, it is presupposed that the student requires instruction from the ground up. He is furnished at nominal cost with a set of drawing tools, and his first lesson, consisting of exercises in drawing lines, circles, etc., is sent to him. Upon the receipt of his sheet of drawings, corrections with elaborate pencil notes are made, indicating where a full line is ragged, or a dotted line irregular in length or spacing, or defects occur in the lettering. To prevent mere copying, the instruction charts are printed out of scale, and the students are at all times obliged to draw from scale. One of the last exercises of the course is to draw a complete steam engine from rough pencil sketches of the parts which have the dimensions upon them. The progress in this department is often remarkable, as may be seen from the accompanying drawing, made from rough dimensioned sketches, which was done by a student whose earlier drawings, made only six months before, are extremely crude and rough.

RAILROAD INSTRUCTION CAR.

In the chemistry, metal mining and electrical courses, as in that of mechanical drawing, the students can secure from the schools sets of apparatus which are put up specially to meet the requirements of the particular courses. Thus the student in telegraphy is provided with a telegraphic outfit, and the student of chemistry with the necessary reagents and apparatus to cover the experiments included in the course. The accompanying photograph shows a student in chemistry experimenting.

The courses of study are laid out with a view to giving special training in subjects which in a school or college course merely form incidental features in what is known as a broad education. In the International Correspondence Schools system these courses are divided into two classes, one including a thorough training in the principles of the subject, the other class including courses for those who wish to make a more special and advanced study of the subject. Thus, under the first head may be mentioned the mechanical and electrical engineering courses, and under the second the stationary engineering and locomotive-running courses. The last course includes the study of everything connected with the running of trains, including, besides the locomotive, the air brake, train heating and lighting and the kindred subjects. In connection with this course the schools keep three instruction cars on the road, the first of which is herewith illustrated. These cars are fitted up with complete air brake and other equipments, in the manner adopted by the chief railroads of the country for the instruction of their own employes.

The corrected papers become the property of the student, and if at any time he should be in difficulties, he can turn to his old records and refresh his memory with the corrections made for him during his course. He is also furnished, as he progresses with his work, with a complete duplicate set of all the instruction and question papers, drawing plates and keys, covering the course, which are bound in half leather and form a valuable reference library for use in his future studies, or in connection with his trade or profession.

To the textbook department falls the important work of preparing the instruction and question papers, all of which are the work of the regular professional staff of the establishment. The selection of these gentlemen has been made with a view to giving to the instruction that practical character which is such a valuable feature of the schools. In every case they have been actively engaged in business, either for themselves or in the employment of well known industrial concerns, and they are thus well qualified by their training to prepare textbooks adapted to the special and practical needs of the student. Most of the faculty are graduates of leading American and European colleges. Among them are to be found former city engineers, ex-chief engineers or ex-chief draftsmen of bridge companies, electrical companies, and general engineering firms, and to this practical experience is to be attributed the clearness, directness, and simplicity which characterize the instruction papers.

Mention of the instruction papers suggests the important matter of illustrating, to which the schools have paid special attention. The excellence of the cuts which appear in the papers is due to the care exercised in the selection of competent draftsmen, and a staff of fifteen (shown in one of the illustrations of the front page) is steadily employed on new work.

It will readily be understood that to carry on a correspondence instruction with over 100,000 students calls for an extensive printing establishment. This work is carried on in five divisions in a separate building. The press rooms, which are located on the first two floors of the building, contain ten cylinder and four job presses. The third floor is occupied by the bindery; and the fourth floor by the book composing room and the proofreaders' room. Work is about to be commenced on a new building, covering over an acre of ground, which will accommodate a printing plant capable of executing all the work of the schools, three-fifths of which at present has to be done in New York and Philadelphia.

From what has been said it will be evident that the new method of instruction as carried out by the Scranton establishment is qualified to rank as one of the most important educational agencies of the day. As long as it is prosecuted along the practical and very thorough lines above described, it cannot fail to exert a helpful and lasting influence upon both the characters and fortunes of thousands of students who devote their leisure hours to its work.

Dwarf Habit of Plants.

M. P. Gauchery has made an exhaustive study of the phenomenon of "manism" in the vegetable kingdom. His general conclusion is that the peculiarities which distinguish the external form and the internal structure of plants are, like other characters, largely dependent on the environment, and are displayed more strongly in the vegetative than in the reproductive organs. A dwarf plant is not a miniature of the species with all its organs developed in the same proportion as they are in a plant of normal size.—Ann. des Sciences Nat. Bot.

Science Notes.

The condition of the obelisk in Central Park is exciting considerable apprehension, owing to the fact that it has begun to disintegrate. It is very unfortunate that the obelisk was not set up in the court in the Museum building.

Prof. Andrew Gray has been appointed to the chair of Natural Philosophy rendered vacant by the resignation of Lord Kelvin. Prof. Gray was at one time assistant to Sir William Thomson, and is well known from his several treatises on electrical science.

A sanatorium for the treatment of officers and men of the regular army suffering from pulmonary tuberculosis will be established at Fort Bayard, New Mexico, and hereafter transfers of enlisted men can be made to this hospital upon recommendation of the medical officers of the army.

According to The Pharmaceutical Era, out of 1,008,500 prescriptions examined, only six per cent were written in the metric system. The information was obtained from druggists in forty-two States and Territories. This is not particularly encouraging, and shows that physicians do not seem to care much about trying the new system.

M. Benard, the French architect, who won the first prize of $10,000 in the international competition for plans for the University of California, which was established by Mrs. Phœbe A. Hearst, has arrived at New York and will at once proceed to California, where he will place himself in the hands of the trustees of the University for the furtherance of their plans.

Barometric readings reduced to true atmospheric pressure are now required by the Weather Bureau, the approximate corrections for gravity being applied to all barometric readings. This correction applies to all mercurial barometers and is nearly constant at any one station. The corrected reading is a standard measure of atmospheric pressure and can be compared to similar corrected readings made at any place in the world.

One hospital in New York has adopted a camera to record minutely the action of patients in epileptic fits and similar afflictions, and many moving pictures have been taken showing the movements in walking of persons afflicted with locomotor ataxia. They are produced slowly on the screen, so that physicians are enabled to study the symptoms carefully. Moving pictures have been taken in Vienna showing operations being performed by great surgeons.

We have received "The Mussel Fishery and Pearl Button Industry of the Mississippi River," by Hugh M. Smith, forming an extract from the United States Fish Commission Bulletin for 1898. It will be remembered that we published an article upon the subject in the issue of the SCIENTIFIC AMERICAN for August 5, 1899, written by Mr. Smith, the author of the present monograph. The subject is one of the greatest possible interest, and Mr. Smith's treatment of it is thoroughly adequate.

Dr. William R. Brooks, director of the Smith Observatory, Geneva, N. Y., has been awarded by the French Academy of Sciences, Paris, the Lalande prize "for his numerous and brilliant astronomical discoveries." The Lalande prize is a gold medal worth 500 francs, or its value in money, as the recipient may select. It was founded in 1802 in honor of Lalande, the learned French astronomer, and is awarded for eminent achievement in astronomical discovery. It is regarded as one of the highest astronomical honors.

Among the foreign exhibits at the Paris Exposition that of the Boers of the Transvaal will be most interesting; 40,000 square feet have been allotted to the Boers. The pastoral life of this people will be shown by a Boer farm, which will portray in a most vivid way the life of the first colonists of the Transvaal. The National Pavilion of the Transvaal will be built in the Dutch style and will display geographical documents, mineral specimens and exhibits showing the methods of instruction in the schools. In the Boer farm will be exhibited the wild animals of the Transvaal. The means and methods of transportation used in the country will also be portrayed. The mining industry will be shown by a five-stamp battery.

It is believed that the recent damage to the great hall of Karnak was caused by a slight shock of earthquake. Eleven columns in all have fallen in the four or five rows north of the axis of the temple, and between this and the wall of Seti I. They all fell in a straight line from east to west, the result being that the westernmost is still partly propped against the pylon of the temple. The ruin is terrible and should be repaired at once if the hypostyle is to be saved. The columns can, of course, be set up again, but the architraves above them are utterly broken and destroyed. M. Legrain, who has been engaged for the last three years in repairing and strengthening the ruins of Karnak, has gone to Upper Egypt to see what can be done toward repairing the damage. The whole building is in such a critical state that it is hoped the Egyptian government will see its way clear to increasing its fund toward the restoration of the temple.

Engineering Notes.

A refrigerating and ice-making plant for the well-known brewing firm of Allsop has been imported from the United States.

An Italian engineering periodical has published a method of sterilizing drinking water by means of peroxide of chlorine, which is so powerful a bactericide that three grammes will sterilize one cubic meter of water at a cost of less than 6½ centimes. This process has yielded satisfactory results at Ostend and elsewhere.

The Italians have added to their system of coast defense batteries of mortars similar to those used in Sandy Hook, which we have already described. Only three, instead of four, mortars are placed in a pit. The indirect plunging fire of the mortars is considered to be of great value in the defense of fixed points against an attack by sea.

The Carnegie Company has gained another point in its long-fought "metal mixer" patent case. The case is now only to be finally reviewed and adjudicated by the Supreme Court of the United States, and upon its decision will depend the validity of the patent covering the metal mixer issued to the late Capt. William R. Jones, assignor to the Carnegie Steel Company, Limited.

The Engineer states that with the electric supply stations in London the boilers and engines in use are divided as follows: Water-tube, 75·5 per cent; marine, 11 per cent; Lancashire, 5·5 per cent; miscellaneous, 8 per cent; while the engines are: High-speed, 62·5 per cent; low-speed vertical, 25 per cent; low-speed horizontal, 6·25 per cent; special, 6·25 per cent. Direct coupling is universal.

Several of the largest abandoned copper mines in eastern Maine will again be operated. The Maine copper mines were in successful operation in 1879 and showed good profits while copper was quoted at 14 cents. The mines could also be operated on a paying basis with copper at 12 cents, but the crash came when the Wisconsin mines put down the price of copper to 8 cents. Now that copper is so high, it will be very profitable to mine it.

It is curious that when China is just on the eve of introducing western methods of engineering she should threaten to demolish the greatest engineering work she possesses; that is to say, the Great Wall, erected 200 years B. C. for the purpose of keeping back the Tartars. It is stated that an American engineer is en route to China in behalf of a Chicago syndicate which is expected to take a share in the contract to be given out by the Chinese government for the demolition of the wall. The Engineer states that one French, two British, and three German firms are also bidding for the work, payment for which is to be in the way of rich concessions.

A central station for the production of acetylene gas is being tested at Tata-Tovaros, Hungary, a city of 12,000 inhabitants. Five miles of pipe covers the city and furnishes gas to 158 street lights and 250 burners in houses. The generating station is located over 600 feet from the nearest house. The gas is produced in four generators by the fall of the carbide into the water. The gas for each group on leaving the generators passes into a cooler and then into a purifier, and finally into two gasometers of 106 cubic feet capacity. The generating plant requires the services of only two men, and the total cost of the installation was $30,000, of which $19,000 went for the pipe system.

The new earthquake-resisting, steel-framed palace for the Crown Prince of Japan is now being designed, and the foundations are being laid, with the view of obtaining the structural steel in February. The palace itself will be built of granite and marble around the steel skeleton. It will be 270 × 400 feet and the height will be 60 feet, and will be built in the French Renaissance style. A Chicago engineer has been called upon to design an elaborate heating and ventilating plant. An American ice manufacturing and electric light system will also be added. It is thought that steel construction will revolutionize the building industry in Japan. The new palace will rest on four hundred deeply anchored steel columns embedded in concrete piers. The Carnegie Company will furnish the steel.

Some samples of the cement used in the antique water conduits of Ephesus and Smyrna were recently subjected to chemical analysis, and the various samples were found to be similar in composition. The waterworks from which the samples of cement were taken were constructed from a period several centuries before Christ to three hundred years after. The chief constituent of the samples was calcium carbonate mixed with a small percentage of organic material. This latter was found to consist of a mixture of fatty acids. Experiments were made with a cement such as burned lime and olive or linseed oil, but it was not found to be permanent. On the other hand, a mixture of two-thirds of either slag or lime and one-third olive oil hardened readily and possessed such great endurance that it led to the belief that this was the composition of the ancient cements which were analyzed.

Electrical Notes.

A locomotive in Texas was recently decorated with 100 incandescent lights for use as an excursion locomotive.

A syndicate has been formed to build a single rail high-speed electric railway on the Behr monorail system, between Liverpool and Manchester.

The Third Avenue Railway Company has contracted with a storage battery company for $400,000 worth of batteries for use in regulating the current.

It is said that successful trials of a telephonic apparatus without wire have been had in Italy. The instruments were installed on moving trains. The details of the experiments and apparatus are very meager.

It is said that the Executive Committee of the Erie Canal Electric Traction Company has adopted the storage battery for use as a motive power, subject, of course, to the approval of the Superintendent of Public Works.

It now appears probable that the Mont Blanc Railway will eventually be built. The line is to be worked electrically, and is to start from Ouches and end at Petits Rochers Rouges. The Arve will be utilized to furnish the necessary power. The line will be 6·83 miles long and there will be twelve stations.

A funicular railway has just been completed up to the Schatzalp, at Davos-Platz. It begins at the rear of the Kurhaus and is about 2,200 feet long. The power employed to propel the cars is electricity, which is generated in the valley by dynamos actuated by gas engines. This is one of the first funiculars in Switzerland to use electricity as a motive power.

At the meeting of the Metropolitan Street Railway Association, President Vreeland shows that out of every 5 cent piece which is collected from fares, the amount obtained by the stockholders is very small. Labor amounts to 0·0195 cent; material, 0·0048½ cent; taxes, 0·0026 ½ cent; interest, 0·0144 cent, making a total of 0·0414 cent, leaving for stockholders 0·0086 cent. In other words, the stockholders of the company get less than ⅞ of one cent out of every fare collected as net profit.

A new species of mountain railroad has been devised in Germany. It consists of an electrically worked rope railway, the railway being in sections, the cars being suspended on rollers. As it is not considered safe to allow a greater distance than 4,000 feet between the supports, intermediate stations are necessary, the passengers changing from the first to the second section and so on until the journey is completed. About seven minutes are occupied in traversing each of the 4,000-foot sections.

At the recent Exposition in Como, the "Voltaic pile" was very much in evidence, not only as an architectural feature of the ill-fated Exposition buildings, but everything in the way of souvenirs was gotten up in the same form. Boxes of chocolate, pepper boxes, almanacs, etc., were all based on this design, and chromo-lithographs and silk handkerchiefs with pictures of Volta were for sale everywhere. These matters all testify to the appreciation of the greatness of this early electrical inventor.

Various methods have been provided for cooling tubes for use in the production of the Roentgen rays. One method is to connect the anti-cathode by an iron rod with a small flask of water at the tube. Another method is to bring the water in direct contact with the anti-cathode; a wide tube of platinum is soldered directly into the glass tube. Its end is cut at an angle suitable for carrying the anti-cathode, which seals the tube hermetically at that end. The other end projects outside the tube, which is bent outward and carries at its extremity a flask of water. This new device has proved of great practical value.

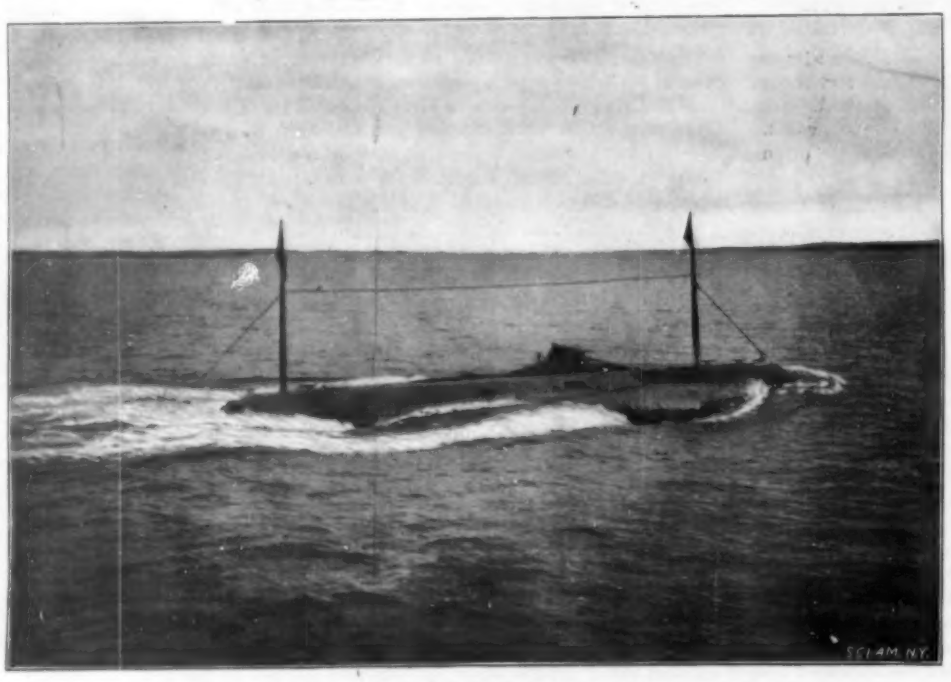
A new telephone transmitter has been devised and is being manufactured in Pennsylvania. It is so constructed that the outer casing and mouthpiece may be removed for the purpose of cleaning without disturbing the diaphragm or its adjustment. This is accomplished by fitting the diaphragm and carbon parts in an inner casing independent of the outer shell. The diaphragm is held in place by a threaded ring which screws on the inner casing. It is, therefore, independent of the adjustment of the mouthpiece or any other condition of the outer casing. The manufacturers adjust the instrument, and no subsequent adjustment is needed.

Germany will make a large display of machinery at the Paris Exposition. Siemens & Halske and Schuckert will each have a dynamo actuated by a 2,000 horse power engine; the Helios Company, of Cologne, will have one of 1,900 horse power installation, and Lahmayer, Frankfort-on-the-Main, will have another of 14,000 horse power. The engines for these dynamos will be supplied by Borsig, of Berlin, the Augsberg and Nuremberg Companies. According to Feilden's Magazine, the crane which is to be used for transporting heavy machines in the central gallery will be supplied by Flohr, of Berlin, and will be capable of raising 25 tons to a height of 40 feet.

THE SUBMARINE BOAT AND ITS FUTURE.

BY WALDON FAWCETT.

The success of the tests of the Holland submarine topedo boat, recently made in the presence of an official trial board, composed of United States naval officers, at Peconic Bay, on the north coast of Long Island, assuredly marks the advent of a new era in the development of submarine craft designed for offensive operations in war. That the case of the advocates of the practicability of such an engine of destruction has been somewhat advanced by the showing made seems probable, but that the element of opposition which has all along existed in official circles has by no means been obliterated is equally certain.

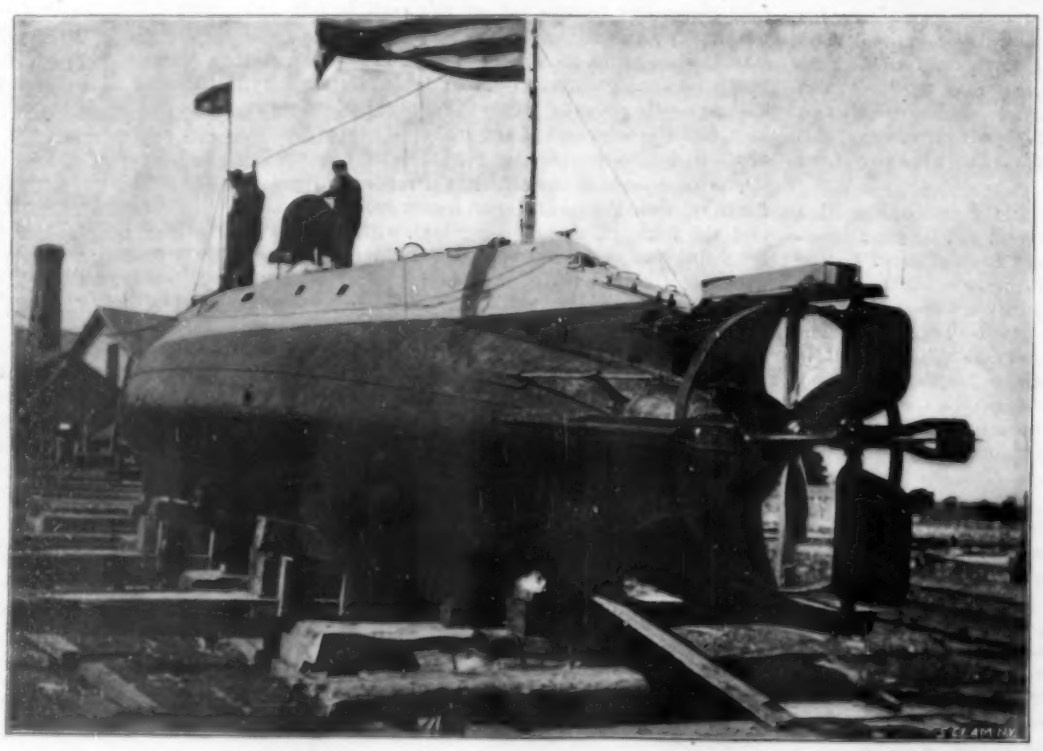


OFFICIAL TRIAL OF THE HOLLAND SUBMARINE BOAT.

Certain of the naval officers who witnessed the recent tests were so favorably impressed with the performance of the boat that they seemed disposed to believe that it would be wise for the Navy Department to build or purchase a number of the vessels for service in conjunction with harbor defenses on both the Atlantic and Pacific coasts. It must be admitted in all candor, too, that in many respects the showing was rather more favorable than any previously made by any other similar boat in any part of the world.

The vessel was on several occasions under water for intervals of more than twenty minutes, and demonstrated her ability to respond to a summons to sink beneath the surface, approach a ship, discharge a torpedo, wheel about in her course and return to a place of safety, all within a space of considerably less than half an hour. Tests were made at depths of about twenty feet, the deepest obtainable in the bay, and the boat demonstrated to the satisfaction of her builders her ability to remain submerged for a space of twenty-four hours without the crew of six men and the torpedo operator being subjected to any danger of asphyxiation, or even to inconvenience. Based on the result of the experiments is a claim that the radius of action under water is five miles per hour for almost six hours. The speed trial developed a speed of eight knots.

The Holland boat with which the experiments above outlined were made is 53 feet in length by 11 feet in width and weighs in the neighborhood of 11 tons. The storage battery, which is thoroughly insulated, is in a compartment amidships, while over this is the conning tower with steering gear, and under it the water tank. The air compressor and gasoline engine for driving the generator are located astern of the battery. Above is the dynamite torpedo tube. The generator may be either driven by the engine to charge the batteries or thrown on to the batteries, running as a motor while the boat is submerged. The motor-generator weighs two tons, and is capable of developing 50 horse power at 800 revolutions, or 150 horse power at 1,200 revolutions. There are small motors for the pumps, the air compressor, and ventilating apparatus.



PROPELLER AND STEERING APPARATUS OF THE HOLLAND SUBMARINE BOAT.

The American boat, since the recent trials, has attracted renewed attention from several foreign naval attachés stationed in this country, and some of these officers have been sufficiently impressed to make the boat the subject of communications to their home governments. That the French authorities may seek to acquire one or more vessels of this type is much more likely than that Great Britain will take up the matter. The British Admiralty has always been strenuously opposed to submarine torpedo boats in general, and when the inventor of the American boat visited London some months ago, he was wholly unable to interest them in the subject.

For the French, however, the submarine boat has ever been an alluring one, and during the years which have been consumed in bringing the American boat to its present stage of development they have experimented with upward of half a dozen distinct types of submarine craft. The more recent series of French experiments opened with those with the "Gustave Zédé," which aroused at the outset an immense burst of enthusiasm. It did not take long, however, to ascertain that the boat's range of action was limited in the extreme. Attention was next turned to the Goubet boat, but it proved thoroughly impracticable. Then the "Morse" was taken up, but investigation proved that her range of action was quite as restricted as that of the "Zédé."

The French government is now experimenting with the "Narvel," a submarine vessel of recent construction. The displacement of this craft is 160 tons and she is fitted with a Forest oil engine, which not only drives the propeller when the boat is either navigating at the surface or with only her lookout and chimney exposed, but also operates a dynamo for charging batteries and accumulators, these being utilized to propel the boat when she is entirely submerged and the chimney unshipped. Sailing at the surface at 12 knots, the "Narvel" promises a range of action of 252 miles, and at 8 knots the range will be 624 miles. When submerged, the accumulators will propel the boat 25 miles at 8 knots, or 75 miles at 5 knots. The "Narvel" is designed to carry two officers and nine men.

The sentiment of hostility to submarine craft of all kinds now so prevalent among British engineers has been induced, of course, largely by the failure of the French boats and other craft constructed in Europe during the past decade, and it must be admitted that the whole history of submarine navigation has not been such as to render a naturally conservative class of men optimistic.

The career of the submarine boat may be said to have extended over fully three centuries, even if no regard be paid to the rather vague assertion of some histories, that Alexander the Great was once a passenger in a submarine craft, the character of which unfortunately is not described. King James I., of England, made a trip in a submarine boat which a Hollander of the name of Van Drebbel built in London in 1664, but the first craft which can be rightfully so designated was that designed in 1776 by a New Englander of the name of Bushnell. This boat, which was propelled by oars, was primitive in the extreme and was destroyed soon after going into commission by the shots of a British man-of-war.

Fulton wrestled with the problem and designed two different types of submarine boats, and there were numerous other attempts, all similarly unsuccessful, until, with the trial in 1887 of Prof. Tuck's "Peacemaker," the present era of experiment in submarine navigation may be said to have been inaugurated. The American boat last mentioned was by no means a marked success; but it served to direct to the subject more attention than it had previously been accorded.

The "Peacemaker" was cigar-shaped, 30 feet long, 8 feet wide and 7½ feet deep. She was lighted by electricity and propelled by a steam engine of fourteen horse power. The boat was submerged by filling her ballast tanks with water and raised by means of a rudder which moved around a horizontal axis. The crew consisted only of an engineer and helmsman, the latter being stationed in a glass-inclosed dome which projected from the upper surface of the hull. There is no record of the boat's having attained a speed of more than 8 miles per hour when well submerged.

At about the same time the British engineers were watching with interest the experiments with the "Porpoise," a small electrically-propelled craft, and the various boats built by Nordenfeldt. The last of these was a vessel 121 feet in length and of 230 tons displacement, the 1,000 horse power engines of which were capable of giving her a speed of 15 knots when immersed, but a few years later she was broken up and sold as junk, and from that time forward British engineers had little faith in attempts at under-water navigation.

On probably no question are the officers of the United States navy more thoroughly divided in opinion than that of the utility of the submarine boat in warfare. The personality of the men who have ranged themselves on opposite sides of the discussion makes it impossible to disregard the arguments of either. On the one hand we have the advocates of this class of craft, who declare that its judicious employment would make it practically impossible for an enemy to successfully attack any of our principal seaports by water. The opponents of submarine operations of the class proposed, on the other hand, base their claims of the impracticability of all submarine craft on the contention that the difficulty of keeping to a course when the boat is submerged would make it impossible to discharge torpedoes with an accuracy in any degree dangerous.

Supplementing this latter argument is that of the British engineers who declare that modern searchlights and other safeguards would insure the destruction of any submarine boat by rapid-fire guns before it could approach sufficiently near to a war vessel to do any harm.

Lieut. A. P. Niblack, U. S. N., one of the best informed officers on the subject of torpedo warfare in the American or any other navy, recently declared that there was no real reason why the submarine boat should not be as successful as the automobile torpedo. This certainly does not seem like an irrational view

when it is remembered that all the things done by a Whitehead torpedo may be done by a submarine boat. Almost the only difference is that whereas in the torpedo the opening and closing of valves, the regulation of depth, the steering, the various safety devices and the length of the run are all automatic, in the submarine boat the corresponding things are all regulated by hand.

One point about the submarine torpedo boat which might almost be considered a disadvantage is the tireless, unremitting care which is an absolute necessity in order to keep the delicate apparatus in condition. Then there is the ever-present danger when the boat is making a trip submerged that the propeller will foul a buoy rope, or chain or mooring, in which event the fate of the crew would be sealed with tolerable certainty, since it would be well nigh impossible to make the needed repairs.

It is not generally known that the submarine torpedo boat "Plunger," building for the United States government at Baltimore, is of an entirely different pattern from the "Holland" (the trials of which at Peconic Bay are above described), although designed by the same inventor. The delivery of the "Plunger," which is a vessel 85 feet in length and of 1,500 horse power, has been delayed between three and four years by a series of unfortunate circumstances and she is not even yet completed. Several changes in the machinery are, however, to be made, and it is expected that the vessel will then be pushed to completion. A congressional appropriation made some time ago for the construction of two additional submarine boats will become available when the Navy Department shall have been thoroughly satisfied with a design.

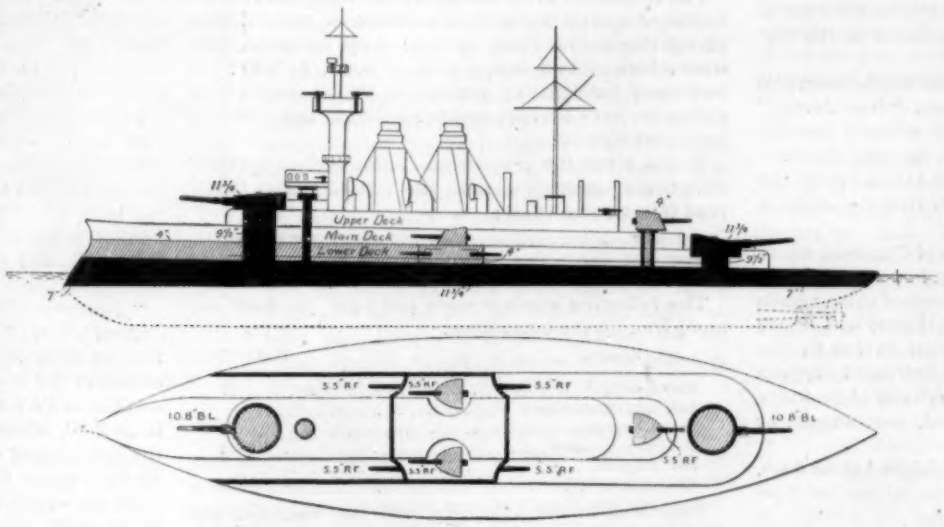
THE NEW FRENCH ARMOR-CLAD "HENRI QUATRE."

Fine fleet as have the French, it has been compared by one of their own experts to a museum of warships, so many and so various are its types. The armor-clad "Henri IV.," launched on August 23 at Cherbourg to the strains of the Marseillaise and (to please France's reputed allies) the Russian National Hymn, will be yet another and a very unique "exhibit" for the collection of men-of-war which the French naval constructors have set afloat in their endeavors to find an ideal type before they commit themselves to any particular line of design. After the experiences of the American fleet in the late war with Spain in which the monitor class proved so very unsatisfactory, it is truly remarkable that this, the latest French man-of-war to take the water, should be an adaptation of this discredited design. For though she has considerable free-board—about 20 feet in fact—forward, which will without doubt render her considerably more seaworthy and comfortable than a monitor pure and simple, yet from the foremost turret to her stern she is a very low freeboard vessel, with a long and high superstructure amidships.

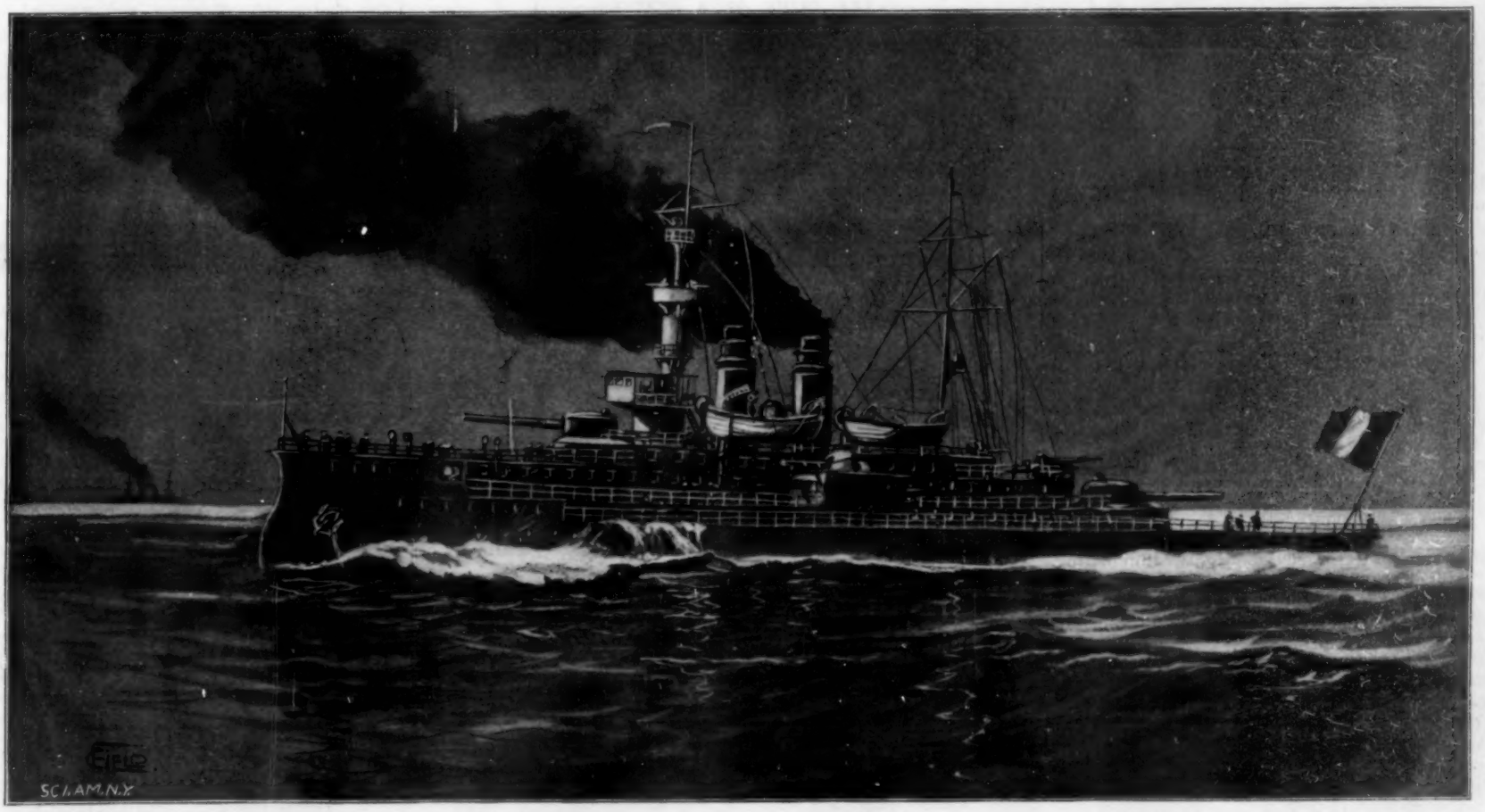
For her displacement—8,948 tons—she will no doubt be an exceptionally powerful vessel both in attack and defense. Her main armament will consist of two long 10·8-inch guns, one of which is to be mounted in a turret forward at a considerable height above the water, while the other, which will be similarly mounted aft, will be placed very much lower down. As a secondary armament she is to be equipped with seven 5·5-inch quick-firing guns. Four of these are to be placed in a casemate or "box battery" amidships, protected by 4 inches of armor, another aft under a shield, high enough up to fire over the roof of the after turret, while the remaining couple are to be placed one on either beam on the top of the casemates. The "Henri IV." will carry in addition twelve light rapid-firing guns and two torpedo tubes. Her flotation is well protected by a very nearly complete belt of 11¾-inch armor which commencing at her bow only stops short a little forward of her ensign staff. Above this from the bow to the after end of the box battery there is another belt of 4-inch plating. The armor on the two turrets has a maximum thickness of 11¾ inches. She has also an armored deck about 2 inches in thickness, and this is continued downward and inward below the belt with the object of affording some protection against torpedoes.

Like most of the newer French ships of any size the "Henri IV." is to be fitted with three propellers, which according to some authorities are calculated to give a ship half a nautical mile an hour more speed than if she were fitted with twin screws. She is very much cut away under water aft, and the central screw will be much further aft than the others, being outside the rudder, which will probably be double.

The boilers of the "Henri IV." are of the Niclausse type and her engines are expected to work up to 21,500 horse power and to give her a speed of 17 knots. Her normal coal supply will be 735 tons, but at a pinch she can carry 1,100, which is calculated to give her a radius of action of 7,580 miles. Her complement has been fixed at 26 officers and 435 men.



ARMOR DIAGRAMS OF THE "HENRI QUATRE."



THE "HENRI QUATRE." LATEST TYPE OF FRENCH BATTLESHIP.

Displacement, 8,948 tons. **Speed,** 17 knots. **Maximum Coal Supply,** 1,100 tons. **Armor:** Main belt, 11¾ inches; upper belt, 4 inches; barbettes, 11¾ inches; casemates, 4 inches. **Armament,** two 10·8-inch; seven 5·5-inch; twelve 3-pounders. **Torpedo Tubes,** two. **Complement,** 461. **Date,** 1899.

Diamond Production of the Transvaal.

According to the United States consul at Pretoria, the output of diamonds in the Pretoria district during 1898 amounted to 11,025 carats, valued at $43,151. In December, 1897, the output was 166 carats, valued at $710, and for the same month in 1898 the output was 3,100 carats, with a value of $11,626. The largest stone found in 1898 was 38½ carats. Although the diamond industry is not developing with abnormal rapidity there is every cause for satisfaction, the first stone having been discovered at Reitfontein only in August, 1897. The average value of stones found in the Pretoria district is $3.89 per carat, the average value of Kimberley diamonds $6.33 per carat, and those found at Jagersfontein, in the Orange Free State, $8.27 per carat. The diamonds in the Pretoria district are found in pipes, as on Schuller's mine and on Montrose. A similar formation has been found on Roodeplaats on the Pienaars River, and another is also reported at Kameelfontein and Buffelsduff. On the De Kroom farm, about 26 miles west of Pretoria, diamonds have been found, but according to the State geologist, not in a blue ground formation. At Byrnestpoort an alluvial deposit is being worked, also one on the adjoining portion of the Elandsfontein farm. The area of diamondiferous ground is very extensive, though its thickness is not considerable. The total quantity of diamonds found in 1898 in the Transvaal was 22,843 carats, valued at $212,812. At the alluvial diggings 12,283 carats, valued at $171,427, were found; while from the pipes 10,560 carats, valued at $41,374, were obtained. The difference between alluvial and pipe diamonds consists in the fact that river stones are of a far better quality and are generally larger.

THE cost of repairing the damage caused by the recent collapse of the columns in the temple of Karnak and strengthening the edifice is estimated at $250,000.

Correspondence.

A Correction.

To the Editor of the SCIENTIFIC AMERICAN:

By a slip of the pen—I will not accuse the types—the statement appears, at the end of my article on the "Heavens in December," in the SCIENTIFIC AMERICAN for December 2, that there will be a nearly total eclipse of the sun on the evening of the 16th. Of course, it should read the moon. GARRETT P. SERVISS.

Krupp and Harvey Armor Compared.

To the Editor of the SCIENTIFIC AMERICAN:

Will you kindly give me the following information: First. How much more efficient is the Krupp armor believed to be than the Harveyized? That is, what thickness of Krupp armor is believed to be the equivalent in resisting qualities of what thickness of Harveyized?

Second. What is the proposed total displacement (*a*) of the battleships of the "Maine" and "New Jersey" classes, and (*b*) of the large armored cruisers recently authorized, and what proportion of the total displacement in each of these classes will be taken up by the armor, and is this on the supposition that the armor is to be Harveyized or Krupp?

What I wish to show to a member of Congress, whom I hope to interest in the matter, is just what the increased expense would be of giving one of these vessels Krupp armor over that required for Harveyized armor of the same efficiency, and also what saving in displacement would be gained by this increased expense which could be devoted either to more complete armor protection or to increasing the coal, ammunition or other supplies.

I believe that you have already published these data, or some of them, but I cannot at once lay my hand on the number of your paper containihg the article. If you could simply refer me to the number, it would probably answer my purpose.

EDMUND M. PARKER.

89 State Street, Boston.

[Krupp armor is about 20 to 25 per cent more effective than Harveyed; a 6-inch Krupp plate being equivalent to a 7½-inch Harveyed, and a 10-inch Krupp to a 12½-inch Harveyed, and others in same ratio. This is probably more applicable to thick than to thin plates, the difference being less in thin plates.

The displacement of the vessels of the "Maine" class is 12,500 tons, and 20 per cent of the same is allotted for armor, i. e., about 2,500 tons.

The vessels of the "New Jersey" class will have a displacement of 13,500 tons and will be allotted about 2,700 tons of armor each, equivalent to 20 per cent of their displacement. The amount of armor will be the same whether Krupp or Harveyed is used, but, of course, the protection will be considerably better if Krupp armor is used, and the cost will also be greater.

The quantity of armor to be carried by the large armored cruisers authorized by last Congress is not yet definitely settled, but probably it will be 10 to 12 per cent of their displacement of 13,500 tons; that is, between 1,350 and 1,620 tons. It will be the same whether Krupp or Harveyed armor is used.

The armor plan for the "Maine" contemplates the use of Krupp armor for the thicker plates and a small quantity of Harveyed armor for the thin plating. The total amount of armor called for is 2,492 tons, costing at $545 per ton for Krupp and $411 per ton for Harvey armor, $1,333,783. To obtain the same protection using Harveyed armor exclusively would require 3,069 tons, costing $1,261,972, an increase of 577 tons, which is not admissible. We may say, therefore, that the use of Krupp armor means a saving of 577 tons in displacement, as compared with the use of the Harvey armor, the saving being made at an increased cost of $71,816. —ED.]

Passenger Car Lighting.

At the last meeting of the Southern and Southwestern Railway Club, Mr. W. E. Symons, for a committee consisting of himself, R. H. Johnson and T. S. Lloyd, presented an extended report on the comparative value, efficiency, cost and practicability of the various types of artificial lights for passenger cars. The report is taken up with descriptions of storage battery, axle light, direct dynamo, combination dynamo and storage, and Pintsch gas systems. In summing up, says The Railway Master Mechanic, the committee finds that the oil lamp, with its offensive odor, annoying heat in hot weather, damage from fire or explosion, either in train accident or otherwise, is fast becoming obsolete, except on some branch or local runs where it would be impossible to use the electric light, the cost prohibitive, or where, from the lack of storage stations, gas cannot be procured. While on all first-class trains in main line service, it would appear that either gas or electric lighting of some system was the standard.

Electricity has passed the experimental stage, says the committee, both as a power and as an artificial light, "and even if stopped in its development where it now is, it must be considered as one of, if not the, greatest invention of the age, and certainly one of positive and enduring utility. That the unknown capacity of the American inventive genius will doubtless cheapen the production to a degree that will practically make its adoption universal we all hope for, and feel assured will be realized at a not far distant day. Owing to the development of electric and other means of artificial lights, none of these figures as to the cost should be considered as permanent or fixed, for from the strides that have been made, particularly in the reducing of the cost of production, no doubt the cost of electric and other up-to-date improved methods of artificial light for trains will be still further materially reduced, until they will be equally as cheap as or cheaper than the oil lamp or tallow candle."

The committee gives the following memorandum as to cost of application and maintenance of mineral seal oil lighting on the Plant system: Cost of lamps, two chandeliers of two lamps each to a car, $172.50; oil consumed for lighting periods of twelve hours, one gallon per car; average cost per light per hour (twelve hour period) 0 025.

It also gives the proportion of the various systems of lighting passenger cars in the United States (Railroad Gazette statistics):

Oil lamps	55 per cent.
Gas	43 "
Electric light	2 "

The following average costs per light per hour are also given by the committee:

System.	Cost per light per hour.
Storage straight	.0·007
Axle light (Moskowits)	
Dynamo straight	0·083
Dynamo and storage	0·043
Gas acetylene)	
Gas (Pintsch)	0 03

Figures as to the axle light and the acetylene gas were not available.

THE CRIME OF A CENTURY.

BY PROF. CHAS. FREDK. HOLDER.

One of the most extraordinary events that has characterized the last half of the present century is the extermination, the wiping out, of the American bison. There is little use in resorting to invective or endeavoring to stigmatize those who are guilty of this crime, but it would be well if the acts could be held up in a bright light, that those who committed them might be excoriated in the time to come, when a few bones and pictures will alone tell the story of a mighty race swept from the face of the earth by the civilized people of the nineteenth century.

"In 1870, and later," said an army officer to the writer, "the plains were alive with bison, and in crossing at places I had difficulty in avoiding them, so vast were the herds. If any one had told me then that in twenty or thirty years they would have become almost entirely extinct, I should have regarded the statement as that of an insane person." Yet the photographs illustrating the present paper fairly represent the last of the bison or American buffalo, as it is popularly called.

That so many of these animals could have been killed in mere wantonness seems incredible when their vast numbers are realized. We first hear of the bison from Cortez and his followers in 1521. Montezuma had one in a zoological garden, the specimen, in all probability, having been caught in Coahuila. In 1530, Cabeza saw them in Texas; and in 1542, Coronado found a herd in what is now the Indian Territory; one of his officers describing them as horrible beasts that demoralized the horses. In 1612, Sir Samuel Argoll observed herds of bison near the national capital, and, in all probability, two hundred and eighty-seven years ago herds of bison grazed on the site of the capitol building at Washington. In 1678, Father Hennepin observed them in what is now Northern Illinois, and in October, 1729, Col. W. Bird saw herds in North Carolina and Virginia.

These and other facts have provided data by which the early geographical distribution of the bison has been determined, and it is known that this grand animal, that is to-day represented by a few individuals, formerly ranged in millions from the Atlantic seaboard to the Gulf of Mexico, from Texas to the Great Slave Lake, and as far west as Central Nevada. As to their numbers, they were like the sands of the seashore, and the accounts given by those who hunted them twenty or thirty years ago, to-day seem like vagaries of a disordered imagination. Mr. Hornaday, who has hunted in South and Central Africa, where game is remarkably plentiful, states that the bison of this country previous to 1870 exceeded, in all probability, all the African game of every kind. An army officer in service on the plains in 1867 stated to the writer that on one occasion he was surrounded by buffaloes, and that from the top of a small hill he could see nothing but a black mass of their bodies. It was impossible to estimate their numbers, and the party were in great fear lest they should be caught in a stampede, the rush being irresistible. Col. Dodge, in his memoirs, states that on one occasion he rode twenty-five miles in Arkansas, always being in a herd of buffaloes, or many small herds, with but a small separating strip between them. The animals paid but little attention to him, merely moving slowly out of the way or advancing, bringing the whole herd of thousands down on him with the roar of an avalanche. This he met by standing fast and firing when they came within short range, the shot causing them to divide. In one day Col. Dodge killed twenty-six bison from his wagon; not in sport, but as a protection. Otherwise they would have run him down and crushed man, horses and wagon.

This herd observed by Col. Dodge was later found to be fifty miles wide and to occupy five days in passing a given point on its way north. From a high rock from which points ten miles distant could be seen in every direction, the earth seemed to be covered with bison. To make an accurate estimate of the numbers seen would be impossible, but Mr. Hornaday, by a conservative calculation, estimates that Col. Dodge must have seen four hundred and eighty thousand, and that the herd comprised half a million buffaloes. A train on the Kansas Pacific road in that State in 1868 passed between the towns of Elsworth and Sheridan—one hundred and twenty miles—through a continuous herd of buffaloes. They were packed so that the earth was black, and more than once the train was stopped, the surging mass becoming a menace to human safety.

"You cannot believe the facts as they existed in the days of 1871–72," said an army officer. "I was at that time on duty in the pay department, which made it necessary for me to travel on the Atchison, Topeka and Santa Fé Railroad. One day the train entered a large herd, which scattered and seemed to go wild at the shrieking of the whistle and the ringing of the bell. As we went on the thicker they became, until the very earth appeared to be a rolling mass of humps so far as we could see. Suddenly some of the animals nearest us turned and charged; others fell in behind, and down on us they came like an avalanche. The engineer stopped the engine, let off steam and whistled to stop them, while we fired from the platforms and windows with rifles and revolvers, but it was like trying to stay a tidal wave. We stood in the center of the car to await the crash, some of the men going to the rear. On they came, the earth trembling, and plunged heads down into us. Some were wedged in between the cars, others beneath; and so great was the crush that they toppled three cars over and actually scrambled over them, one buffalo becoming bogged by having his legs caught in the window. Such accidents occurred several times, and twice in one week were trains derailed by charging buffaloes, whose numbers it was impossible to compute.

Hunters have heard the roaring of buffaloes at a distance of from three to five miles, and that the earth trembled when they charged we can well imagine when the large bulls are known to weigh two thousand pounds, the cows twelve hundred pounds. The question of interest to-day is how was it possible to destroy so many animals in so short a time and what methods were employed. The natural fatalities were few compared to the enormous numbers. The cow bison displays little affection for her young, and many calves were lost every year; but all in all, the conditions were extremely favorable to them, and their increase was enormous. Many were destroyed by stampeding over precipices. In 1867, two thousand buffaloes, or half a herd, became entangled in the quicksands of the Platte River. At another time a herd was lost by breaking through the ice of Lac Qui Parle in Minnesota. The cold winters sometimes killed many that remained in the far North; but these dangers were as nothing compared to man. Man soon found that the buffaloes had a value. The Indians slaughtered them by the thousand for their skins, bone and for food; they killed one hundred oftentimes to secure five, and waste and prodigality were the rule. Yet so vast were their numbers that doubtless the Indian inroads upon them had little effect so far as extermination is concerned; but with the white man it was different. Some wished to make records, and killed for sport; some killed for the hides and heads; some became professional buffalo butchers to provide the gangs of railroad men with meat, slaughtering a magnificent animal for its tongue alone. It has been estimated that previous to 1870 nearly three-quarters of a million buffaloes could have been killed yearly and the herds kept intact; how many were killed and wasted will never be known. Each animal, however, had a value at this time estimated by Hornaday at $5; the robe, $2.50; the tongue, 25 cents; hindquarter meat, $2; bones, horn and hoofs, 25 cents; and this was sufficent to attract an army of destroyers. The hides were the greatest feature, and one firm in New York between 1876 and 1884 paid the killers nearly $1,000,000, or to be exact $923,070, for the robes and hides, which represents the final extinction of the animal. The government never interfered, owing to protests of interested legislators and the neglect of higher officials. Another firm paid $216,000 for robes and skins, and there were scores of private traders in the field. The word went out to

kill everything in sight, and from 1876 there was a price on the head of every buffalo.

It is a dark and disagreeable subject to probe, but it is interesting to note some of the methods of these national calamity makers. A band of half-breeds in two hunts, according to Ross, killed 47,770 buffaloes, 620 men being engaged in the sport, out of which about 30,000 animals were wasted or partly eaten. Hornaday estimates that from 1820 to 1825 five buffalo

BUFFALO CALF.

expeditions went out, composed of 610 carts each, killing 118,950 buffaloes. From 1825 to 1830, five expeditions, of 750 carts each, killed 146,250 buffaloes. From 1830 to 1875 six expeditions, of 895 carts, killed 174,528 animals. From 1835 to 1840, fifty-four expeditions, of 1,090 carts each, killed 212,550 buffaloes. Total number killed by the Red River half-breeds alone in twenty years, 652,275, valued at $3,261,375. An interesting table has been furnished the government by the firm previously mentioned, J. & I. Boskowitz, showing the decline of the buffalo as an article of commerce. It shows that in nine years this firm handled 246,175 skins, costing $924,790. In 1878, they received 41,268 robes; in 1883, 5,000; in 1884, none. The end had come and the buffalo was a memory. Another dealer, Joseph Ullman, states that in 1881 he handled 41,000 robes valued at $3 50, and 12,000 at $7.50. In 1882, he purchased 40,000 hides at $3.50 and 10,000 robes at $8.50. The prices hunters received were: Cow hide, $3; bull hide, $2.50; yearling, $1.50; calves, 50 cents. The expense of transportation brought the hide up to $3.50 in New York. This dealer, in four years, paid out $310,000 to these men, who killed buffaloes by the tens of thousands for $2.50 per head. Both of the above mentioned dealers, in eight years, paid out $1,233,070 to the exterminators.

That the real extermination of the buffalo was caused by the demands of trade there can be no doubt, aided and abetted by sportsmen, Indians, and others; but the blame really lies with the government that in all these years permitted a few ignorant Congressmen to block the legislature in favor of the protection of the bison, so that all the efforts of humanitarians were defeated and the bills when passed pigeon-holed.

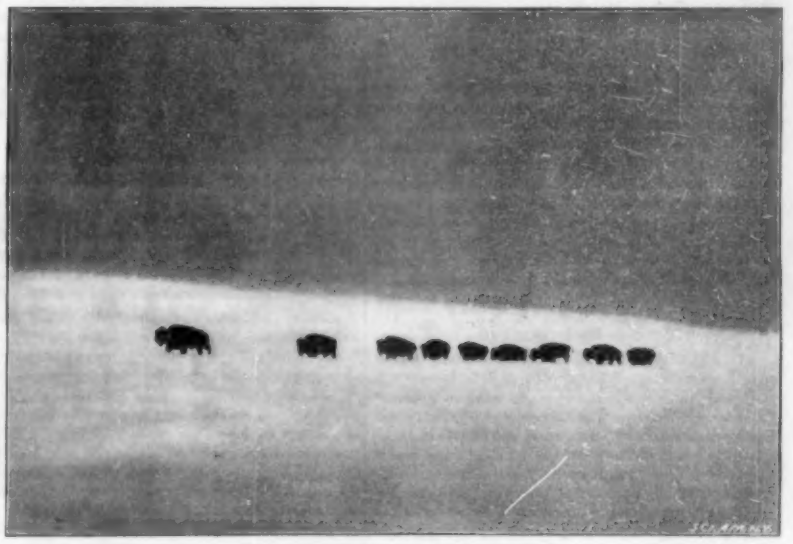
There were many methods of extermination that are graphically illustrated by paintings and models in the Smithsonian Institution. The still hunter was the most insidious enemy of the buffalo, and a single man by sneaking upon a herd has been known to kill one thousand in a single season. One Captain Jack Bridges, of Kansas, has the honorable (?) record of having killed 1,142 buffaloes in six weeks. He took the contract to that effect and bagged his game. Up to 1870 there were undoubtedly several millions of buffaloes alive, but the lust for blood was on, and soon came the demand for robes and hides from the dealers, and men who could not make a living at anything else went out to kill buffaloes. In the different States there were regular killing outfits that cost, in rifles, horses, carts, etc., from two thousand to five thousand dollars. Such methods developed some famous characters. Buffalo Bill was one. He contracted with the Kansas Pacific Railroad to furnish them with all the buffalo the men could eat as the road was built; and according to Mr. Cody's statement, they ate 4,280 buffaloes in eighteen months, for which he received $500 per month, the price he paid for his title.

Many buffaloes were killed by running them down; this was the popular method among the Indians, who shot them with rifle or bow and arrow, or chased them over precipices. The great herds north of the Missouri were mostly exterminated by the Indians of the Manitoba Red River settlement, who hunted them in a regular army. One division of such an army of exterminators consisted of 603 carts, 700 half-breeds, 200 Indians, 600 horses, 200 oxen, 400 dogs. The movements against the buffaloes in Nebraska were often made by three thousand people, and as each man killed at least ten, thirty thousand buffaloes bit the dust. In this way Indians as above killed, it is estimated, 652,000 buffaloes.

The completion of the western railroads divided the buffaloes into two herds, northern and southern. In 1871, the southern herd was composed of an estimated 3,000,000, and from now on the animals dropped away so rapidly that it was estimated that 3,000 or 4,000 a day were killed. It became evident that they were doomed, and appeals were made to the government by hundreds. From 1872 to 1874, there were 1,780,461 buffaloes killed and wasted; 3,158,780 in all killed by white people and the skins shipped east over the Atchison, Topeka and Santa Fé road. During the same time the Indians killed 390,000; besides these settlers and mountain Indians killed 150,000, so that the grand sum total for these years was 3,698,780. In the following year, 1875, the deed was done. The southern herd had been swept from the face of the earth; the northern herd went in the same way. In 1882, it was believed there were 1,000,000 buffaloes alive in the herd, but there were at least 5,000 white hunters in the field shooting them down at every point. Such a merciless war of extermination was never before witnessed in a civilized land. Then came 1883; thousands took the field this year, and Sitting-Bull and some whites had the honor of killing the last ten thousand.

There were living at the last government census, made eight years ago, 256 pure-blooded buffaloes in captivity, the last of the untold millions that covered this continent during the past century. Some of them are shown in the accompanying photographs, which tell a pitiful story of the greed of the white man and the extirpation of a mighty race within three decades.

BISON AND YOUNG.



BUFFALO IN DEEP SNOW.

A Tribute.

We have received the fourth number of Feilden's Magazine, published in London. Although this handsome periodical has been published only a few months, it is already in the front rank of technical journals, and by the breadth of its scope, the independence of its opinions and the splendid manner in which it is gotten up, it has already obtained honorable distinction among the English technical journals. We notice in the November number a handsome compliment to ourselves; it says, "We are not aware of any weekly newspaper in this country (England) which possesses the eclectic scope together with the editorial authority of the SCIENTIFIC AMERICAN. In the highest class of technical journalism we are more than able to hold our own; but in journals of a discursive nature as applied to science and mechanics we must look beyond the Atlantic for an example."

The National Export Exposition.

It is said that the National Export Exposition has been a creditable, and on the whole, a successful enterprise. Half of the exhibits came from Pennsylvania, and a considerable portion of the remainder came from the States which immediately adjoin it. There were many classes of goods which were conspicuous by their absence, such as textiles and electrical machinery. The amount of running machinery was very small, a 200 horse power gas engine actuating it all. It is stated that during the last few weeks of the Exposition, the average sales were from $50,000 to $100,000 a day. If this is the case, it shows that the primary object of the Exposition has been fulfilled.

A Shower of Bielids.

A well-marked shower of Bielid meteors was observed at Princeton on the evening of November 24. At ten o'clock the meteors averaged two or three per minute at times. Professor Young counted forty-two in the first half hour between ten and eleven o'clock, and there were many others which he did not see. After eleven o'clock Professor Young saw only three meteors in fifteen minutes. They were mostly small, but a dozen were above the second magnitute and two rivaled Sirius. They all left trains, but these were evanescent, not persistent, like the trains left by Leonids.

The December Building Edition.

The December number of the BUILDING EDITION is fully up to the standard of its predecessors, and we are safe in saying that it is one of the most beautiful publications in the world. The houses are admirably selected and the engravings are reproduced with care and are finely printed. Those of our subscribers who are not familiar with our BUILDING EDITION should send for a sample copy. Each issue contains a number of special features, such as reproductions of European castles, villas, iron work, etc.

The Current Supplement.

The current SUPPLEMENT No. 1249 has many articles of great interest and permanent value. "Engineering in the United States Navy—Its Personnel and Material," is the annual address of Rear-Admiral George W. Melville before the American Society of Mechanical Engineers, of which he is President. "The Modern Armor-Clad" is continued and describes minutely the system of military masts, torpedo tubes, barbettes, etc. "Some Physiological Effects of Hydrocyanic Acid Gas upon Plants" describes some most interesting experiments by Prof. W. G. Johnson, of Maryland Agricultural College, and State Entomologist.

Contents.

(Illustrated articles are marked with an asterisk.)

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

LAWN-MOWER.—WILLIAM NEWBY, Pittsburg, Pa. The revolving cutter-blades of this mower radiate from a common center. The stationary cutter-blade has its edge turned toward the rotary cutter and is held by a revolving support at an angle to the cutting edge. Both cutters have an adjustable support. An auxiliary adjusting device is arranged to carry the rotary cutter toward the stationary cutter; and another device acts to separate the two cutters. The auxiliary devices are carried by the adjustable support. The cutter by reason of this construction may be adjusted at any desired angle relative to the ground.

POISON-DISTRIBUTER.—FRANK L. RICHTER, Cuero, Tex. The invention provides a machine for distributing poison upon plants, which machine is under the complete control of one man and is arranged to distribute poison simultaneously upon three to seven or more rows of plants. The distributing-nozzle may be readily adjusted to pass over plants of different heights. The ingredients of the poison are thoroughly mixed in a receptacle independent of the distributing-receptacle during the period in which the machine is in operation. Such preparations as wood-ashes, sugar, and arsenic can be employed.

Engineering-Improvements.

GOVERNOR FOR TRACTION-ENGINES.—CARL K. THOE, Oslo, Minn. The inventor has devised an improvement on governors in which an eccentric is shifted across the driving-shaft by centrifugal force. The governor is arranged to insure a proper distribution of steam under varying conditions of operation, especially when reversing the engine, to keep the initial cylinder-pressure equal to the boiler-pressure and to cut off the steam in exact variation of the load and pressure. A more perfect distribution of steam is obtained than with the valve-gear now in use, especially as the lead of the valve is varied according to the speed and to the cut-off and compression. There is no lead when the engine is started; and consequently no back-lash is produced to retard the engine.

ROTARY GRATE-FURNACE.—CHARLES GROLL, Roubaix, France. The invention is an improvement in that class of smoke-consuming furnaces in which the combustible is automatically distributed upon a grate having a rotary movement which is either continuous or intermittent. The main improvement is found in a construction of the grate-bars which provides for the air a series of broken passages, the effect of which is to increase the division of the air.

SELF-FEEDING SMOKE-CONSUMING FURNACE.—CHARLES GROLL, Roubaix, France. The furnace comprises a rotary grate, which may be of the type described in the foregoing notice; a casing located radially above the grate and spaced therefrom; and a coal-distributer provided with a spring-actuated coal-ejector. A coal-feeder is movably mounted in the casing and has inclined channels arranged to receive coal from the distributer and to deliver it upon the grate. A mechanism is provided for shaking the coal-feeder. The distributer enables wet coal to be used; and the quantity of coal passing through each series can be obtained either by varying the number of cells or by changing the dimensions. The furnace may be operated either with natural or forced draft.

Mechanical Devices.

HYDRAULIC AIR COMPRESSOR.—LEE E. MITCHELL, Boston, Mass. The purpose of this invention is to provide a device which will be operated by a flow of water to compress air. The compressor comprises a tank having an air-discharge valve, an air-inlet pipe extending upwardly within the tank and terminating in a valve-seat upon which is adapted to rest a valve guided in movement by the pipe. A sleeve surrounds the pipe and carries at its upper end a float and at its lower end a water-pan. Connections are provided for securing opposite action of the valves. A rock-shaft having a counterpoise is operatively connected with the water-controlling valves and the sleeves surrounding the air-inlet pipe.

PAPER-COATING MACHINE.—WILLIAM H. WALDRON, New Brunswick, N. J. This machine has a number of coating-rollers arranged at an angle to each other, and a turning device for the paper between the coating-rollers. The device serves to turn the paper after it has passed over one coating-roller, to present its other face to the second coating-roller. The apparatus is to be used as an adjunct to a paper making machine, but is also adapted to be used separately, if desired.

STREET-SWEEPER.—ALVIN BROWN, Aurora, Ill. There are two principal features in this invention which deserve to be emphasized. One is the peculiar construction of the main frame and the other is the special arrangement of the dirt-chamber and movable dirt receptacles, which are so constructed as to be arranged within each of the sweepers to receive the dirt. When filled, they are run out upon rails to a truck, upon which a number of them are carried away to the dump; while other empty receptacles are placed on the sweepers. The arrangement enables the sweepers to work constantly, thus saving time and permitting one driver and one team to take a number of dirt-receptacles to the dump at one time.

AUTOMATIC FIRE-SPRINKLER.—LEROY A. WESTON, Adams, Mass. The fire-sprinkler is used in connection with a system of water-pipes laid along the walls or ceiling of a room and provided at intervals with openings closed by a valve held to its seat by a support. The support is made in sections held together by a fusible joint, so that when the temperature of a room becomes dangerously high, the joint will fuse, causing the separation of the sections of the valve-support and the consequent outlet of the water through the valve. The invention is concerned with the provision of an improved valve-support which increases the efficiency of the apparatus by rendering the fusible sections more sensitive.

PLUNGER-HEAD FOR TILE-PRESSES.—BENJAMIN D. TRAITEL and WILLIAM C. LEIBER, Manhattan, New York city. The purpose of this invention is to provide a tile-press with a plunger-head which will form a tile with undercut depressions in one face into which the cement or bonding material is forced to hold the tiles effectively in the setting. The plunger-head is formed with a cavity and yieldingly sustains a die-plate. A ping moves diagonally in the die-plate, its upper end projecting in the cavity of the plunger-head and bearing against the head. A spring is passed transversely through the upper end of the plug and has its ends twisted to bear on the upper face of the die-plate, whereby the plug is raised relatively to the die-plate.

FIRE-ESCAPE.—DUARES N. JERAULD, Newport, Ky. The fire-escape comprises a reel on which a lowering-rope is wound. A lever guides the rope from the reel to the outside of the building and has a brake-arm carrying a brake-band engaging the reel. A rewinding device is provided for the reel, which device comprises a reel gear-wheel secured on the reel, a spring, and a second gear-wheel in mesh with the first gear-wheel and connected with one end of the spring. The fire-escape takes up but little room and enables a person to descend from a window with the utmost rapidity, the speed being automatically regulated according to the weight of the person.

CLOTH-MEASURING DEVICE.—JESSE H. KING, Escatawpa, Miss. The device is intended for measuring and recording the lengths of bolts of cloth or for measuring off any required strip from a bolt, and is provided with a receptacle in which the bolt lies. The end of the cloth is taken from the bolt and passed over a roller upon which it is held by a presser-plate. The cloth is received by a reel supported by a standard, hinged at its base so as to swing away from the reel and leave its end free, to permit the removal of the cloth. The reel is rotated by gearing so constructed that the speed of rotation may be multiplied. The roller has a worm formed upon the outer end of its shaft, which worm engages a worm-wheel, to the upper side of which a registering-disk or dial is secured.

Railway-Contrivances.

CAR-COUPLING.—VALENTINE ERBACH, Scranton, Pa. The car-coupler is so constructed that a one-piece draw-head will present all the advantages of a draw-head of the pivoted-knuckle type. The draw-head is provided with fixed knuckles adapted to interlock with similar knuckles upon the opposing draw-head. A pin in the draw-head can be automatically operated during the act of coupling and used in connection with a link when desirable; by its means cars can be uncoupled even when there is little or no slack.

RETAINING VALVE.—JOSEPH S. LAPISH, American Fork, Utah. This automatic retaining-valve for Westinghouse air-brakes comprises a cylinder forming the escape for the brake-cylinder and having connection by a triple-valve slide-valve with the auxiliary reservoir. A spring-pressed piston in the cylinder is adapted to be forced outward by the pressure from the auxiliary reservoir to close the brake-cylinder escape. The piston is also adapted to return by the pressure of its spring to open the brake-cylinder escape.

BALL-BEARING.—FREDERICK H. HEATH, Hotel Gerard, New York. This ball-bearing for car-axles comprises a spherical journal-bearing upon which a series of curved resilient spacing-rings are secured. Balls are placed between the spacing-rings. Cage-rings are provided, having holes to inclose the balls partly. Staples or loops carried by the rings further inclose the balls, and a suitable journal-box surrounds the balls.

AERIAL RAILWAY.—MAURICE BROCHET, Levallois-Perret, France. In the aerial railway devised by this inventor, a train of cars is caused to travel overhead upon a structure supported by pillars. The train is so constructed as to form practically a rigid self-supporting beam or girder, so that the stationary parts connecting the pillars act mainly as guides for the train and in some cases as supports for electric wires, but are not strictly necessary for supporting the train. The rigid connection between the cars can be temporarily suspended to enable the train to travel on curves or over points where the grade varies.

MAIL-BAG DELIVERER AND RECEIVER.—HUGH A. ORCHARD, Hoodhouse, Ill. The railway mail-bag catcher consists of inner and outer uprights connected by a slide-rod. A catching-arm is provided with a ring sliding on the rod, the middle of the arm being detachably secured to the inner upright by spring-operating catch devices. A stop on the slide rod limits the movement of the bag-catching arm. The bag can be set to be taken by a car coming in either direction, a hook on the car seizing the ring, and sweeping the bag into the car without shock or danger of striking the car.

GUARD FOR CAR-AXLE BOXES.—JAMES S. PATTEN, Baltimore, Md. As the result of continued experiments and tests on cars in regular service this inventor improved the wooden and metallic dust-guards which he has already devised. The present guard comprises members slidable on each other and provided with outwardly extending ribs along their semicircular inner edges, the entire portion of the latter, thus thickened and broadened being beveled for the purpose of enabling the dust-guard to be easily and quickly applied to the axle.

RAILWAY-CROSSING.—GEORGE P. KEITH, Rochester, Ind. The crossing consists of two connected rails and carries locking-bars adapted for engagement underneath the rails of the main tracks. An air-pressure actuated rod supports the crossing. Connections between the locking-bolts and the rod enable the bolts to be moved to their releasing position upon a rotary movement of the rod. The rotative movement of the rod swings the crossing into the desired position. The crossing may be easily and quickly operated to place the rails of either one of the two intersecting tracks in continuity, so that a train may pass over without undue jarring.

EXPLOSIVE SIGNALING APPARATUS FOR RAILWAYS.—WILLIAM R. SYKES, Station Road, High Street, Clapham, London, S. W., England. The apparatus comprises a gravity-operated cartridge magazine having a series of pairs of cartridge-chambers adapted to be brought into firing position under the control of an escapement, one pair at a time. A pair of gravity hammers normally held raised, explode the cartridges and are automatically reset by the force of the explosion. The fall of the hammers is electrically controlled so as to render the discharge dependent on the position of the signal lights. When the parts fail to act, an electrical warning is given. The discharge and the operation of the cartridge-chambers is rendered dependent on the passage of a train.

Miscellaneous Inventions.

PICTURE-FRAME.—HENRY R. TURNER, Helena, Ark. The invention consists in forming corner-pieces for a picture-frame from a piece of tin or other metal by bending two edges of the sheet at right angles to it and punching a hole in the corner opposite to that in which the right-angled edges meet. Four of these plates are slipped over the four corners of the picture and then wired together.

INHALER.—LOVELAND M. FRANCIS, Phœnix, Arizona Territory. The inhaler has a cylindrical body portion, in the ends of which tapering shields are carried. The small ends of the shields are projected into the body portion to hold a sponge between them and to form a space for the reception of liquid. Besides serving as a means for holding medicinal preparations to the nostrils, the device is also applicable to respirators or devices for protecting persons from poisonous gases by placing over the nostrils a means for purifying the atmosphere before it is inhaled.

MINING-CAISSON.—ANTHONY F. LUCAS, Beaumont, Tex. The caisson is made in cylindrical sections which are successively bolted one on top of the other to form a continuous, tight, vertical caisson, which is gradually sunk to bed-rock by hydraulic action. The caisson is provided with a boring-face, with means for extending the lower section into bed-rock and securing it therein with a watertight connection, and with special means for turning the entire caisson to produce a boring action to facilitate its downward movement through the stiffer bodies of clay.

COTTON-PICKER'S SPRING SPINE-SUPPORTER.—SAMUEL C. POTTS, Apple Valley, Ga. By means of this device the back of a cotton-picker is relieved from the strain of a stooping position. The support comprises a main bar of spring material which can be attached to the shoulders. A cross-bar fixedly secured to the main bar near its lower end is arranged for attachment to the hips. The main bar extends below the hip-bar and is provided at its lower extremity with straps for attachment to the thigh.

RUNNER FOR VEHICLES.—CHARLES S. SAXTON, Blue Earth City, Minn. The runner is adapted for attachment both to straight and bent axles and can be adjusted to track. An oscillating axle-clamp is provided and likewise checks for limiting the movement of the clamp, thus obviating the necessity of straps to prevent the body's turning over. A construction is provided whereby the draft will be below the center of the axle, causing the runners to travel smoothly and have but little tendency to tip or travel upon their noses.

BALL-BEARING FOR BICYCLES.—FREDERICK H. HEATH, Hotel Gerard, Manhattan, New York city. The present invention provides an improvement in spherical and ball bearings, that is to say, bearings in which one of the two members or surfaces between which the balls run is formed on spherical lines. The bearing consists of a hub, a cup-member fitted therein, and a spherical member carried by the axle. A cone member is fitted to the spherical member so as automatically to adjust itself thereon. And a series of balls is fitted between the cup and cone. There is no binding or cramping action.

FURNACE FOR HEATING SOLDERING-IRONS.—GEORGE BICKELHAUPT, Manhattan, New York city. In the casing of the furnace a burner is arranged, consisting of a number of oppositely-extending arms. A support consisting of oppositely-extending arms carries a shaft adapted to rock in the casing and to be locked to hold the support in a central position relatively to the burner. A furnace thus constructed is light and can be connected by a rubber tube with a gas-pipe.

VENTILATING ATTACHMENT FOR WINDOWS.—GEORGE M. WAGNER, Philadelphia, Pa. By means of the construction devised by this inventor, one or more panes can be simultaneously removed from the main sash and securely held in a position enabling them to be readily closed. The ventilation is accompanied by no objectionable draft. The attachment is especially adapted to all forms of windows having prism glass and serves to keep the prisms in the same position when opened and when closed to obtain the full benefit of the deflected light. The attachment opens inwardly instead of outwardly, thereby permitting the use of bars or screws outside of the window.

TOOL.—MERVIN W. TOZER, Dunton, Colo. The invention is an improvement in tools having handles in which a number of tool-bits are carried. The handle has separated jaws and multiple bits between them. Jaws and bits have holes for receiving a clamping and pivot bolt, through which holes another bolt passes having an apertured head adapted normally to engage the outer surface of one jaw to clamp the jaws together. The jaw in question has projections on opposite sides of the bolt which are adapted to coact with the apertured head to hold the tang of an extra tool, the bolt-head meanwhile being raised from contact with the jaw, and the clamping-pressure being communicated to the jaw through the tool-tang and projections.

CABINET AND SAFE.—DANIEL N. SHOEMAKER, Cainesville, Mo. The cabinet provides separate storage-compartments for all materials used in baking, and a safe to receive the bread or cake when baked, the safe being so constructed that it can be ventilated or tightly closed. The cabinet has a kneading-board and bins of simple construction, which can be locked with their tops uppermost and turned bottom upward for cleaning purposes.

RAILWAY TICKET.—GRANT S. ATHERTON, Brooklyn, New York city. The object of the invention is to provide a passenger, transportation, or theater ticket designed to prevent so-called "scalping" on the part of speculators. The ticket consists of a sheet having its longitudinal edges folded over the central portion to form three layers and doubled transversely about midway between its ends. The sheet is also transversely folded adjacent to one end in an upward direction, so that the folded end portion is between the other end portion and the central portion of the sheet. The overlapping folds are fastened or sealed together. The ticket is to be opened only by the conductor and is otherwise void.

HYDRANT.—CHARLES L. BURKHART, Dayton, Washington. When not in use, this hydrant can be moved wholly below the ground surface, thus preventing any possibility of freezing. The hydrant comprises a supply pipe, with which a chamber communicates. A hydrant pipe is vertically movable through the upper and lower walls of the chamber and is adapted to rotate, and is provided with ports through which the water may pass from the chamber when the pipe is in its uppermost position and through which the water may discharge when the ports are below the chamber.

WATER-FILTER.—EMIL T. DREIER, Hanapepe, Kauai, Hawaii. This water-filter for house use has a casing with a water-supply connection. A cylinder extends within the casing and has a longitudinal bore therein and exteriorly connecting passages extending outwardly from the bore. A carbon filtering-stick in the bore communicates at one end with a discharge-passage.

KNOB ATTACHMENT.—CHARLES J. ERICSON, Salt Lake City, Utah. To provide a door-knob attachment which will securely lock the knob on the screw-spindle and to prevent transverse play of the spindle in the lock, is the purpose of the present invention. The knob-shank has a fixed clutch member and an opposing clutch member is longitudinally movable on the spindle but held from turning. A forked plate is arranged to straddle the spindle in rear of the movable clutch-member and to be secured directly to the door in rear of the escutcheon. The parts of the fork are longer than the diameter of the movable clutch member, whereby the plate alone holds the movable clutch-member from rearward movement, thereby enabling the fastening to be used with any style of escutcheon.

PACKING FOR STUFFING-BOXES.—HERMANN KIRSCHNING, Berlin, Germany. The packing is made of asbestos threads in the form of rings, ropes, and the like. The invention secures simplicity in the mode of plaiting the asbestos threads by the help of a spiral or serpentine wire, attains greater elasticity, and facilitates the making of the packing in various shapes.

NECK-YOKE CENTER.—CHARLES W. MCDONALD, Gallatin, Mo. The invention is concerned with improved means for adjustably connecting a neck-yoke or spreader-bar with the pole of a vehicle. Connected with a neck-yoke and a clip-band having two projecting spaced flanges is a cam-block pivoted between the flanges. A pole-ring also has two spaced flanges between which the cam-block is pivoted at right angles to the other pivot-bolt. A clamping-dog is pivoted so as to lie between the flanges of the pole-ring and to receive pressure from a toe on the cam-block.

MANTLE FOR ELECTRIC-ARC LAMPS.—PAUL MERSCH, Avenue Hoche 9, Paris, France. The purpose of this invention is to enhance the lighting power of an arc lamp, the radiated heat being partly reflected on the carbon and partly absorbed, whereby the mantle is rendered incandescent and the arc-light given a milder and warmer tint. The effect of the oxygen of the air is diminished by the greater rarefaction of the air thus produced in the close neighborhood of the carbon electrode. The mantle is made of clay, alumina, and kaolin.

COMBINED ROCKING-CHAIR AND LOUNGE.—OLE A. BROWN, Lawrenceburg, Tenn. The combined rocking-chair and lounge consists of rockers connected at their forward ends by a fixed foot-board, and of an adjustable back. A foot-rest is pivotally mounted between the rockers beyond the fixed foot-board. A flexible strip is connected with the pivoted foot-rest and back, whereby when the pivoted foot-rest is folded back, the fixed foot-board may be used by a person in the chair.

ICE CREAM FREEZER.—FREDERICK P. BURR, Middletown, Conn. When the ice-packed receptacle is partially filled with the cream to be frozen, it is rotated alternately in opposite directions. The cream is caused to flow up the inner wall of the receptacle to form a hollow center; at the same time the liquid freezing-mixture is caused to travel in the vessel and to move up on the external surface of the receptacle to insure a thorough cooling and final freezing of the cream. Since the freezing-mixture is several degrees colder than the ice, a rapid freezing of the cream takes place, because only a thin layer of cream is opposite the layer of external freezing-mixture. The rapid change in the direction of rotation causes a very quick freezing.

Designs.

BROOM-RACK.—HENRY C. BOTHWELL, McArthur, Ohio. The leading feature of the design is a compartment-receptacle, with standards, cross-bars, and apertured longitudinal bars. The rack is designed for use in grocery stores.

PUZZLE-BOARD.—JAMES H. WHITE, Bronx, New York city. The board comprises essentially a maze and the puzzle consists in starting from a point near the edge and in endeavoring to reach the center along certain lines by jumping alternate spaces. The puzzle or, more properly, the game is played with a checker-like object.

LACE-FASTENING.—HENRY A. FRYE, New York city. The fastening for shoe-laces has its top or crown rounded transversely on its upper side and provided with a slot having a flaring end for the reception of the lace.

SHIRT-PATTERN.—WILLIAM GERHARDT, Manhattan, New York city. The essential features of the design consist in the approximately straight side edges and the top edge having gore-like incisions, between which is a concave edge and outward of which are straight edges running into concave edges. By means of this pattern a shirt can be cut from a single piece of linen, thereby considerably facilitating the making of the material into a garment.

CASING FOR WATER-HEATERS.—CHARLES O. F. YOUNGSTROM, Phœnix, Arizona Territory. The casing constitutes a neat means for inclosing the heater and is constructed with a straight edge so that it can be placed against a wall.

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(7769) A. B. K. asks how emery paste or razorene is made and pressed into cakes. A. Mix fine emery intimately with fat and wax until the proper consistency is obtained in the paste, and then rub it well into the leather strap. Prepare the emery by pounding thoroughly in a mortar the coarse kind, throwing it into a large jug of water and stirring well. Immediately the large particles have sunk, pour off into a shallow plate or basin and let the water evaporate. This emery is better for polishing and other purposes than that prepared at the emery mills.

(7770) E. W. B. writes: I have a number of valuable film negatives so curled, and the gelatine so hard, that they cannot be unrolled without injury. Have tried solutions of glycerine of various strengths, but on drying they curl as bad as ever. Kindly give a remedy. A. Sometimes the roll holder film will curl till like a pipe stem, but if soaked in a five per cent solution of gelatine, and pinned on to a board, they will be found quite manageable when dry. Where there are many films to deal with, a better way is to cut strips of thinnish sheet lead, each the length of the films and ¾ of an inch wide. These are folded along their length, making grooves into which the edges of the films are inserted, the thumb firmly drawn from end to end, making them tight enough to hold them fast till dry. Some samples of gelatine are so contractile as to draw the film from the lead grooves, but that may be avoided by making several awl holes through both thicknesses of the lead and pinning them to the board.

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FOREIGN PATENT AND TRADEMARK LAWS. A Comparative Study, with Tabular Statements of Essential Features of Such Laws. By Arthur P. Greeley, Assistant Commissioner of Patents. John Byrne & Company. Price $5.

No one has made a more thorough study of foreign patent and trademark practice than Mr. Arthur P. Greeley, Assistant Commissioner of Patents, whose connection with the Commission appointed under the Act of Congress to revise the patent and trademark laws of the United States and whose progressive spirit with reference to improving the practice within the Patent Office qualifies him especially for the work in hand. The above entitled work, therefore, commands the attention of all those who are interested in patent practice, and no work has yet been published which gives, in so convenient a form and so thorough a manner, an exposition of foreign patent practice. The information to be obtained concerning foreign patent laws appears ordinarily in abstracts or in scattered notes which the attorney has made for his own use during the course of his practice. The work that we have before us represents an immense amount of labor, and the tables have been put in such a form that the most important information concerning foreign patent practice may be obtained with a minimum of effort, owing to the comprehensive system of classification employed. In the first portion of the book, the different systems of granting patents are discussed, with special chapters on the questions of novelty, subject matter of patents, who can apply for patents, etc. In these pages the author has discussed the difference between the patent practice of France and the United States, and has illustrated the working of the English patent system as well as pointed out wherein the German patent laws resemble, in some respects, the laws of the United States, and in other respects the English system. With the laws of these four countries taken as a standard, the practice of other countries is discussed, and the resemblance of their patent laws to one or more of the systems first presented is set forth. Following this is found a set of tables where the principal countries are alphabetically arranged, with abstracts of the important features of their patent laws. These tables will be found of the greatest service to patent attorneys. The pages devoted to the trademark laws explain the differences between the laws in those countries where the property in a trademark is derived from its registration, and in those where the act of registration is merely to complete ownership, the first step to secure which was taken when the mark was first used in trade in the country. The discussion of this subject is of the greatest value. The subject of the registrable forms of marks in the different countries is also treated. Again, as in the first half of the book, which is devoted to patents, the principal features of the trademark laws are arranged in table form so that information can be easily found. In the last pages, before the index, which is very complete and adds greatly to the value of the work, will be found copies of the conventions and treaties to which the United States is a signatory. We heartily recommend this work as being of the greatest value and assistance.

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Milk urn, N. Musiar 637,815
Mill. See Grinding mill.
Mixer. See Meat mixer.
Motor. See Turbine motor.
Motors, apparatus for indicating direction or rotation of, H. Kabler 637,873
Mowers, adjustable ball-bearing for lawn, H. Deck 637,861

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Mowing machine, M. B. Hayes	637,982
Musical instrument, B. E. Benhardus	638,000
Musical instrument, J. A. Weser	638,092
Necktie holder, G. A. Pond	637,933
Necstyle, cylindrical, J. W. Campbell	637,764
Nursery chair, W. H. Weston	637,911
Nut lock, A. W. Holliday	638,056
Nut lock, S. S. Roswell	638,146
Nut lock, E. J. Timmons	638,078
Oil burner regulating device, Frost & Biddle	638,107
Oil container, motor, Vivinus & Hecht	638,130
Ore reducing furnace, L. Correa	638,089
Ore separator, electromagnetic, E. Kreusser	638,120
Oscillating meter, A. Lotz	638,055
Oven, baker's, P. W. Klein	637,803
Oven door, L. Lee	637,805
Overshoe, P. J. Batchelor	638,164
Packing, piston rod, F. D. Philp	638,138
Pad. See Collar pad.	
Paddle for boats, bow-facing self-feathering, J. A. Walker	638,061
Padlock, permutation, C. Studer	638,076
Pan. See Dust pan.	
Paving repair plant, portable, F. A. Hetherington	637,800
Pen bar banking zinc, E. M. Jillson	637,797
Pencil holder, L. A. & W. H. Parker	637,880
Photometer, J. F. Byington	637,955
Photographic shutter, E. F. Edgecomb	638,105
Piano tuning pin, L. Walker	638,154
Pipe. See Tobacco pipe.	
Pipe coupling, H. F. Noyes	637,886
Pipe thread protector, W. Heston	638,117
Plaiting or goffering fabrics, machine for, J. A. Groebli	637,895
Planter, corn, J. R. Ayers	637,954
Plow, E. F. Murray	637,909
Plow, Putnam & Maxfield	637,973
Pneumatic tube ends means for connecting, U. F. Smith	638,188
Post hole digger, W. Ritschard	637,830
Postal car bag catcher, T. E. Hendricks	637,962
Pot. See Flower pot.	
Potter's tool, H. K. Headley	637,781
Pottery ware brushing apparatus, D. Hufhand	637,795
Poultry fattening booth, W. S. Furnas	638,108
Preserve jar or cover therefor, J. E. Lemyre	638,022
Press. See Letter press. Printing press.	
Pressure gage, differential, C. B. Heintz	638,052
Primary battery, Blumenberg & Overbury	638,038
Printer's lock-up and furniture, W. G. Slauson	638,072
Printing machine, platen, M. T. Barber	637,916
Printing plates, machine for making, J. S. Duncan	638,176
Printing press, S. G. Gross	637,777
Printing press, R. Miehle	637,813
Printing purposes, zinc bed for, Burlich & Walzel	637,920
Prism lights, machine for grinding, F. C. Soper	638,189
Propelling boats, means for, H. H. Fefei	637,959
Pruning implement, Herwick & Lonergan	638,116
Pulley, expansion, C. G. W. Wernicke	637,939
Pump coupling, air, H. K. Austin	637,915
Pump regulator, steam, W. A. Wood	637,983
Pump valve mechanism, T. J. Barbour	637,759
Puzzle, A. H. Kopetschny	637,804
Quinin compound, tasteless, A. Weller	637,839
Rack. See Hay and stock rack.	
Rail joint closure, H. C. Quesenberry	637,827
Railway cross-tie, O. M. Knox	638,054
Railway, electric, E. Warwick	638,155
Railway gate, R. J. Tatham	637,836
Railway, pleasure, H. Funk	637,775
Railway, surface-contact electric, D. Robertson, Jr.	638,186
Railway ties, etc., device for extracting, A. Zetter	637,843
Railways, pneumatically operated contact shoe for electric, S. H. Libby	637,806
Rake. See Hay rake.	
Razor box, safety, F. Kampfe et al	638,126
Reciprocating drill, A. E. W. Moissner	637,809
Recorder. See Log recorder.	
Reel, V. G. Hazard	638,012
Reel for angling, etc., A. J. Arnold	638,194
Rein holder, driving, A. Mendenhall	637,811
Relay and distributer, combined, K. Himrod et al	637,799
Retort door and means for closing same, J. B. Houston	638,122
Rod coupling, Hinkle & Ashmore	637,790
Roofing, sheet metal, H. O. Reese	638,064
Rope controller, O. E. Osborne	637,820
Rotary engine, W. L. Casaday	638,173
Rotary engine, J. H. Darragh	637,986
Rotary meter, I. Smith	638,073
Rule, scoring, C. A. Meadows	637,898
Ruler, M. Rosenberg	637,832
Rust, composition for removing, V. C. West	637,910
Saw guide, adjustable, Fox & Meredith	638,049
Saw handle, detachable, J. M. Mariner	637,880
Sawing machine, J. Gillies	637,961
Scale, drawing, J. Ditson	637,857
Screen. See Window screen.	
Screw driver and holder, G. Hoepner	637,990
Seal, A. B. Schofield	637,898
Seal lock, W. K. Edgar	637,840
Seal lock, W. F. Traves	638,079
Sectional boiler, S. E. Porter	638,302
Separator. See Cream separator. Ore separator.	
Separators for ore, coal, etc., feed chute for, F. Pardee	638,062
Sewer pipes or traps, clean-out for, J. J. Phelan	637,822
Sheave, self-lubricating, S. Mattson	638,057
Sheller. See Corn sheller.	
Shutter slat holder, W. G. Smith	637,949
Sickle head, B. F. Williams	637,951
Sign, changeable electric light, Tripp & Stephenson	637,905
Signal. See Block signal. Visible and audible signal.	
Signaling, electrical and selective, J. A. Barrett	637,846
Singletree attachment, H. C. Holzheimer	638,120
Skirt protector, G. S. Hensel	638,013
Smoke consumer, Morris & Norrman	637,885
Smokeless furnace, C. Timmann	638,034
Sofa and bed, W. T. Rolf	637,976
Soil breaking machine, W. M. Wilkey	637,840
Soles with plugs, machine for providing leather, A. Groeschel	637,779
Speed reducing mechanism, S. L. Gould	638,181
Spool carrier, J. Sommer	637,901
Spool for webs of paper, H. L. Cowles	637,853
Sprayer, I. N. Johnson	637,798
Spraying apparatus, W. H. Rice	638,206
Spring cushion, H. A. Moyer	637,814
Stacker, pneumatic, J. A. Walsh	638,191
Stamp, hand, R. H. Smith	638,187
Stamps into strips, machine for cutting sheets of, Hewitt & Bridoux	638,014
Stand. See Fitting or draping stand.	
Starting switch, J. W. Gibbs	638,110
Steam boiler, water tube, J. B. Furneaux	637,892
Steam generator and superheater, H. Cruse	638,036
Sterilizer, O. H. & W. M. Jewell	637,796
Stirrer, portable pneumatic, W. J. M. Dobson	638,046
Stop mechanism, F. T. Leilich	638,182
Stopper. See Bottle stopper.	
Stove, H. Q. Hood	637,991
Stove, A. Ohnemus	638,124
Stove, camp, C. V. Kuder	637,995
Stove or range lid, W. Enatzky	638,104
Submerged heater, E. J. Byrne	638,195
Suspenders, A. Coleman	637,924
Swinging gate, J. A. Hamelback	638,115
Switch. See Electric switch. Starting switch.	
Switch mechanism, electrically operated, S. L. Foster	637,900
Table, W. H. McHugh	638,000
Tank and tank heater, combined, Pawley & Miller	638,025
Telegraph instrument, J. L. Cutler	638,101
Telephone circuit, J. J. Moller	637,894
Telephony, J. S. Stone	638,152
Telescopic box, hinged, C. J. Russell	637,897
Terminal head box, H. E. Procunier	637,894
Thill coupling, W. Gepford	638,109
Tie. See Railway cross tie.	
Tire setter, C. S. Smith	637,834
Tires, apparatus for applying vehicle, B. F. Kenna	637,974
Tires, etc., valve for pneumatic, O. J. Brown	637,919
Tobacco cutter, plug, W. W. Holliday	637,870
Tobacco pipe, Kurth & Masters	638,170
Tobacco prier, plug, D. M. Bonar	638,097
Toe stiffener for footware, F. A. Finch	638,048
Tooth, artificial, H. D. Justi	638,019
Tracing instrument, E. F. Chase	637,923
Track jack, Kintner & Bonham	637,801
Transformer, constant current, R. Fleming	637,773
Trap. See Animal trap.	
Trapeze, revolving, A. Stirk	638,033
Tread for wheels, stairs, steps, etc., H. B. Haigh	637,993
Trestle, extensible, E. C. Bishop	637,847
Trimmer. See Lawn trimmer.	
Trolley, Merrill & Woodsome	637,812
Trolley wire cleaner, R. Dunning	638,047
Trousers support or stretcher, A. L. Ross	638,068
Truck, J. H. Hartzell	637,807
Truck for driving up creeping railway rails, Case & Mayhall	638,094
Trunk, G. A. Boynton	638,096
Turbine motor, N. Nilsson	637,816
Two-piece box, M. Armstrong	637,757
Trympan gage, O. Johnson	638,124

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Typesetting machine, A. Dow 637,303
Typewriter, book, J. H. Myers 637,346
Typewriting machine, M. S. Carmona 638,091, 638,092
Typewriting machine, N. R. Marshman 638,131
Typewriting machine, H. McDougall 638,027
Udder protector, W. H. Hanna 637,780
Umbrella runner, S. E. Smith 638,074
Undershirt, suspensory, M. J. Nerney 637,817
Valve, P. H. Reardon 638,142
Valve for engine cylinders, relief, A. Kiay 637,304
Valve, inflating, J. S. Hemenway 637,782
Valve, roller reciprocating, J. Stabe 637,845
Vault cover, B. Willard 637,881
Vehicle brake, C. J. Ebbets 637,771
Vehicle motor, B. L. Peck 638,029
Vehicle, wheeled, H. Nevill 638,133
Velocipede crank shaft, E. G. Latta 638,021
Ventilator, J. A. Gavin 637,863
Vise, millwright, J. F. Valliere 637,979
Visible and audible signal, combined, R. M. Dixon 637,925
Voltmeters, protecting static, E. M. Hewlett 637,785
Voting machine, H. C. H. Cooper (reissue) 11,732
Wall, wooden, P. F. Kesting 637,937
Washing machine, W. G. Gibbins 638,180
Washing machine reversing mechanism, Reams & Smith 637,835
Water closet valve device, P. J. Madden 637,967
Water heater, D. Heft 637,893
Water heater, I. E. Reis 638,144
Water heater burner, I. E. Reis 638,143
Water heater heating element, B. Becker 638,165
Water wheel, current, T. J. Ingels 638,123
Weighing apparatus, automatic, M. E. Ressert 637,906, 637,907
Weighing machine, automatic, E. Hanak 637,989
Weighing machine, coin-actuated, E. B. Fenby 637,928
Well tube lifting apparatus, A. Bergerson 638,001
Wheel. See Water wheel.
Wheelbarrow, W. J. Freed 638,106
Window lock, gravity, Witty & Reeves 638,037
Window screen, A. Graham 637,951
Wire stretcher, B. C. Hancock 638,051
Wrench, M. O. Carter 637,921
Yoke, neck, W. H. Bayley 637,917

DESIGNS.

Atomizer, W. C. Downey 31,892
Bell gong, E. D. Rockwell 31,888
Clamp band, T. W. G. Cook 31,895
Clutch member, A. F. Sternberg 31,897
Color exhibiting card, J. E. Patton, Jr. 31,910
Electromotor casing, J. Post 31,898
Escutcheon, A. L. Reed 31,911
Eyeglass guard, M. W. Kaufmann 31,883
Fans, air deflector for electric, E. W. Brown 31,899, 31,900
Filter press plate, Hinken & Turney 31,890
Fork, loosening, F. M. Swartz 31,896
Game board, M. Lecioux 31,908
Game board, A. E. Libby 31,907
Garment supporter loop, G. E. Adams 31,912
Glass receptacle, C. W. Klein 31,885
Grate hook shell, B. W. Burdick 31,903
Hat, N. F. Conway 31,915
Knitting machine cam, W. Shaffer 31,902
Lamp body, F. W. Hedgeland 31,887
Nipple, nursing, C. W. Meinecke 31,884
Oven, H. Adler 31,905, 31,906
Pillow top, R. Astorita 31,909
Plate lifting bar shell, B. W. Burdick 31,904
Plate, oyster, F. E. Burley 31,886
Shade bracket, window, J. B. Gill 31,889
Shoe, N. C. Bohr 31,914
Skirt and shoe protector, G. S. Hensel 31,913
Supporting leg, W. C. Peet 31,893
Tile, sewer, D. & J. D. George 31,891
Tool bag, M. M. Deem 31,901
Tug fastener, V. M. Dixon 31,894

TRADE MARKS.

Ale, S. S. Pierce Company 33,813
Boots and shoes, Puritan Shoe Company 33,802
Clothing, certain named, Mayfield Woolen Mills 33,799
Coffee, B. W. Blauvelt Company 33,814
Earthenware, china, porcelain, and parian, P. Schelley 33,808
Golf supply goods, certain, Crawford, McGregor & Canby Company 33,827
Groceries, certain named, W. E. Sibley 33,815
Hair and scalp, preparations for the, J. C. Ayer Company 33,820
Leather, chemical preparation for the preservation of, Semeline-Compagnie, Gesellschaft mit Beschrankter Haftung 33,818
Liqueur made with cherries, L. Fremy, Fils 33,810
Liquors, malt, M. C. McDonald Bottling Company 33,812
Medicinal preparation for certain named diseases, A. E. Larzelere 33,823
Medicine for certain named diseases, Yohn Chemical Company of Baltimore City 33,822
Medicine for certain named diseases, proprietary, Micajah & Company 33,824
Paper, certain named H. Lindenmeyr & Sons 33,805
Paper, certain sizing material used in manufacturing, Hovey & Crumb 33,819
Papers, certain named, Dill & Collins 33,804
Pills, tonic, Dad Chemical Company 34,825
Plumbing fixtures, certain named, Kenney Company 33,829
Precious stones and semiprecious stones, C. F. Wood & Company 33,807
Provisions, certain named, C. M. Aikman 33,816
Remedies, catarrh, E. Taeschner 33,821
Remedies in powdered form for certain named diseases, Vitapura Company 33,825
Rubber footwear, certain named, Monarch Rubber Company 33,803
Sanitary supplies, certain named, C. M. Hobby 33,828
Shoes, Churchill & Alden 33,801
Soap containing petroleum, M. Jenkins 33,817
Spectacles and spectacle-temples, S. G. Marshuts 33,806
Underwear, N. Hatch 33,800
Valves, Castree & Shaw Company 33,830
Wagons, Moline Plow Company 33,831
Whisky, Simms & Walker 33,811
Wine, spirits, liqueurs, and olive oil, A. & J. Dubos Freres et Cie 33,809
Woolens and woolen dress goods, F. Almy & Co. 33,798

LABELS.

"Egyptian Water Nymphs," for cigarettes, G. Grossas & Company 7,212
"Natural Early June Peas," for canned goods, United States Printing Company 7,222
"Natural Golden Wax Beans," for canned goods, United States Printing Company 7,220
"Natural Lima Beans," for canned goods, United States Printing Company 7,221
"Natural Stringless Beans," for canned goods, United States Printing Company 7,223
"Natural Succotash," for canned goods, United States Printing Company 7,219
"Natural Wax Beans," for canned goods, United States Printing Company 7,218
"Old Reliable Rye Whisky," for whisky, United Wine and Trading Company 7,214
"Paz de Oro," for cigars, American Lithographic Company 7,211
"Pearl Wedding Rye Whisky," for whisky, United Wine and Trading Company 7,213
"Perfection Brand Plum Pudding," for plum pudding, E. G. Stevenson 7,217
"Roachine," for insect powder, W. W. Gardner 7,216
"Young's Witch Hazel and Almond Cream," for a toilet preparation, J. F. Young 7,215

PRINTS.

"Iosota," for flour, Derby Mill and Elevator Company 184

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